

TRADITIONAL ECOLOGICAL KNOWLEDGE
OF
20TH-CENTURY ECOSYSTEMS AND FISH POPULATIONS
IN THE
KUSKOKWIM BAY REGION

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Cover photo: The western side of the Ahklun mountain range; processed smelt; spawned-out sockeye salmon; and processing salmon. USFWS photos

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ABSTRACT

This study documents traditional knowledge of six Yup'ik Eskimo elders of the lower Kuskokwim Bay area currently residing in the villages of Quinhagak and Goodnews Bay. Informants described their observations of the abundance and distribution of local anadromous and freshwater resident fish species over the past 88 years (1916 to 2004). The study focused on fish life history, migration, spawning, distribution, past and present subsistence activities, and long-term trends in subsistence fish populations in the lower Kuskokwim Bay drainages. Information was gathered on six species of Pacific salmon (including rainbow trout), Dolly Varden, Arctic char, lake trout, Alaska blackfish, burbot, northern pike, rainbow smelt, round whitefish, Bering cisco and Pacific herring. According to these six key respondents, the most important species for local subsistence harvest over the course of their lives were Chinook, sockeye, chum, and coho salmon, Dolly Varden, Arctic grayling, Alaska blackfish, rainbow smelt, and Bering cisco. Although much has changed over the course of the lives of these six people in regard to harvest technology, processing methods, and access to other goods and resources, the fish species that were valued and harvested 80 years ago are still consumed today.

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INTRODUCTION

The purpose of this report is to describe six local elders' knowledge of fish species and the fisheries important to the subsistence needs of residents from two communities in the lower Kuskokwim Bay region of Southwest Alaska. This report focuses on fish life history, migration, spawning distribution and abundance, past and present subsistence uses and practices, and long-term trends in subsistence fish populations in the specified drainages. Included for context are brief summaries of participating elders' life histories, their recall of seasonal rounds of subsistence harvest activities to place fish in the framework of all resources gathered, and a short discussion of the elders' observations of changes in the climatic and physical environments over their lifetimes.

This project is based on the premise that traditional ecological knowledge (TEK) is a valuable body of knowledge that can make a unique contribution to what is known about the region, for local resource managers as well as the public at large. Berkes (1999: pg. 8) defined TEK as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment." The value of this type of knowledge has not been lost on the managers of natural resources in Alaska. Indeed, the last 20 years has seen a florescence of TEK-based projects statewide (Fall, Chythlook, Schichnes and Morris 1996; Freeman and Carbyn 1988; Georgette and Shiedt 2005; Huntington and Mymrin 1996; Langdon S. J. 2006; Moncrieff, C. F. and Klein 2003; Ramos and Mason 2004; Simeone and Kari 2002). The information in these studies is seen to be complementary to scientific investigation, providing local knowledge of, and valuable participation in subsistence and resource management projects.

This report addresses several fisheries management issues that the Togiak National Wildlife Refuge (the Refuge) and the Federal Subsistence Board are called upon to deal with in planning, management and in evaluation of proposals to change regulations of the area fisheries. The communities of Quinhagak and Goodnews Bay are within the federal Kuskokwim Fisheries Management Area (Figures 1 and 2). In 2002, the Bristol Bay and Yukon Kuskokwim Subsistence Regional Advisory Councils, the Office of Subsistence Management (OSM), and others identified critical fisheries-monitoring issues and information gaps for the Kuskokwim Region. Several key issues include obtaining information about the subsistence fish species and documenting the TEK of fisheries on the Kanektok and Arolik rivers. Gathering elders' knowledge about these species and their ecosystem is one way of addressing this concern.

In addition to providing data to address information gaps, this project also seeks to meet the needs of the participating communities and local inhabitants. Regionwide, village councils and community members are concerned that federal management regulations accurately reflect the observations and localized knowledge of the area's longtime residents. To do this, entities such as the Refuge must identify and document critical habitat and the customary and traditional uses of subsistence resources. At the same time, both Native and non-Native communities recognize that elders of the region are lost each year. With their passing, priceless historical knowledge on subsistence activities and the environment are gone as well. Village councils and Refuge staff thus seek opportunities to document and preserve traditional knowledge of local elders.



Figure 1. Togiak National Wildlife Refuge.

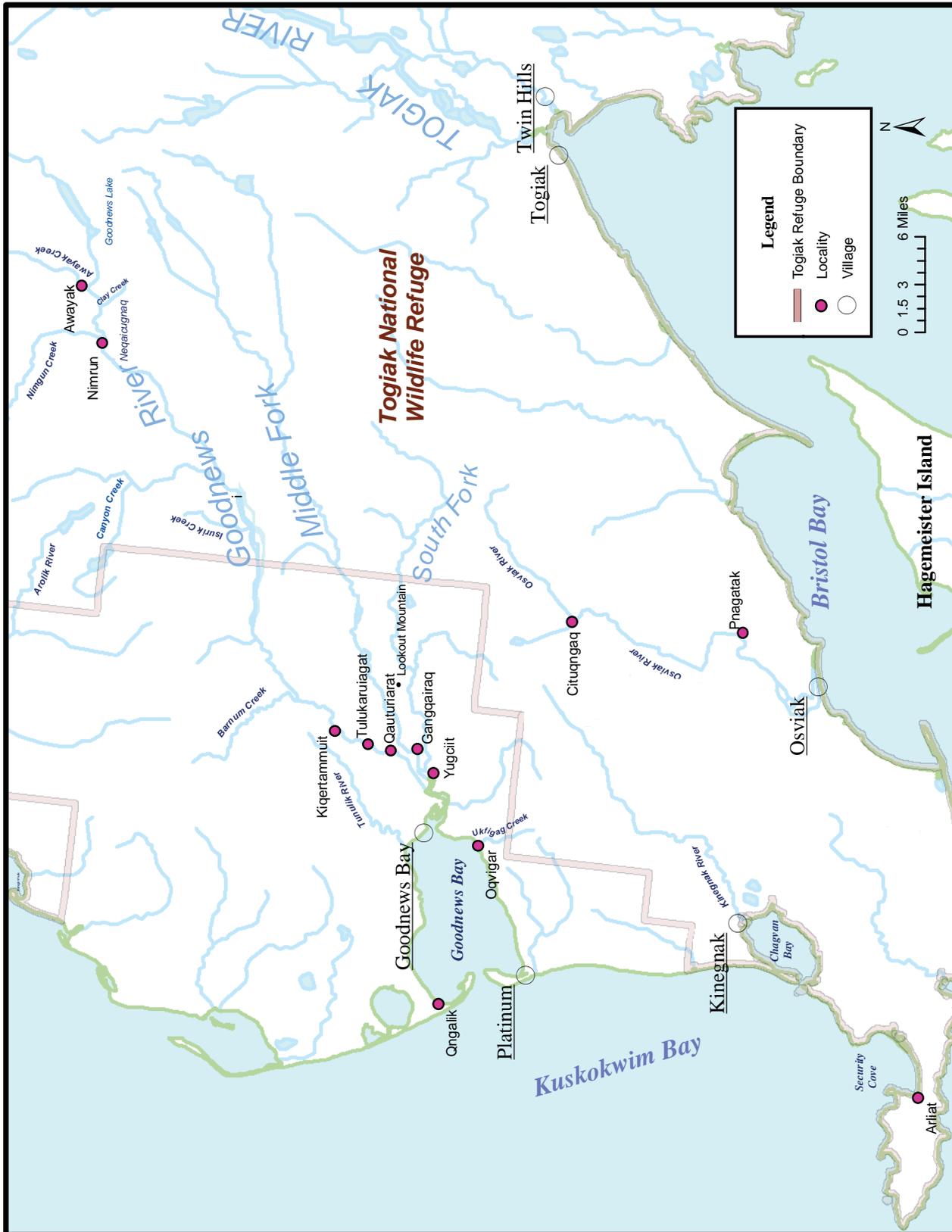


Figure 2. Goodnews River drainage and place names.

This project was preceded by another, “Oral History and Traditional Ecological Knowledge Gathering within Togiak National Wildlife Refuge.” In 2002 the Refuge initiated a project to gather oral history and traditional knowledge in order to elicit a more precise and detailed account of resource response to human impact and environmental change within the Refuge (LaVine and Lisac 2003). The study was designed as a pilot project and funded by the Refuge. It was designed in cooperation with the USFWS Office of Subsistence Management, Alaska Department of Fish and Game (ADF&G), University of Alaska Fairbanks (UAF), Bristol Bay Native Association (BBNA), Association of Village Council Presidents (AVCP), and was supported by the traditional councils of Quinhagak, Togiak, Manokotak, and Dillingham.

As initially conceived, the 2002 study was broad in scope, aiming to document traditional knowledge on all species and environmental change over the lifetimes of eight informants. With the aid of the village councils, elders were identified from the communities of Manokotak, Togiak, and Quinhagak. These individuals were Kenneth Cleveland and Elsie Small of Quinhagak; Natalia Taday, Dan Nanalook, and James Yako (now living in Dillingham) of Togiak; and Petla Apalayak, Julia Apalayak, and Henry Alakayak of Manokotak. Although the participants may have spent a significant portion of their adult lives in these communities, many were born elsewhere within the region. Four elders were born into communities that no longer exist as populated settlements: Kulukak, Kinegnak, and Apokak. Their knowledge of the area was extensive, collectively covering the land extending from Eek to Dillingham.

This project was begun in 2004, building upon work started in 2002. A different methodology from that used in the previous project was developed to focus interviews in a more species-specific direction. This project allowed the Refuge to conduct follow-up work with the elders in Quinhagak who participated in the 2002 interviews.

Objectives

The overall goal of this project was to gather and preserve the TEK of subsistence-fisheries resources and environmental changes observed by long-term residents of the lower Kuskokwim Bay region, and to produce this information in a format of use to natural resource managers. Specific objectives include:

- Inventory and evaluate existing information on subsistence fisheries and existing interview data relating to TEK for the fisheries resources of the Lower Kuskokwim Bay area.
- Evaluate 2002 and 2003 interview data using the questionnaire checklist to determine relevancy of information to the study objectives and plan follow-up interviews as required (two to three interviews per respondent).
- Identify four to six additional village elders not previously interviewed to participate in the study.
- Conduct pre-interviews and subject-focused interviews of four to six elders from the three subject villages (two to three interviews per respondent) to document:
 - a. local knowledge of the life history, distribution, abundance, and ecological relationships of the anadromous and resident subsistence-fisheries resources, and how that may have changed over time;

- b. historical subsistence fishery harvest patterns and traditional fishing areas, and how they may have changed over time;
 - c. local elders' observations concerning changes in the climatic and physical environments.
- Create a relational TEK database gathered during this project so that relevant information is searchable by type, species, and geographic location.
 - Create a spacial database containing TEK information regarding subsistence fish observations and usage gathered during this study and from other sources.

Study Area

The geographic focus of this study is on the area that drains the west side of the Ahklun Mountain range into Kuskokwim Bay within the Refuge in southwest Alaska (Figure 1). The Refuge encompasses 4.9 million acres, of which 4.1 million is administered by the USFWS with the remaining lands in private title or claim.

The Refuge is composed of rugged mountains, glacial valleys, lakes, rivers, sand and gravel beaches, and coastal cliffs, and lowlands (USFWS 1990). Tundra covers much of the Refuge. Alders, willows, cottonwood, and spruce forests, and nonvegetated areas such as glaciers, rocky alpine summits, and gravel bars cover most of the remaining area.

The aquatic habitats in the study area vary from freshwater mountain streams and lakes to low-gradient rivers, and isolated ponds and coastal tidal estuaries and bays. The primary river systems included are those that enter Kuskokwim Bay from the Kanektok River south to Cape Newenham. They are the Kinegnak, Unaluk, Salmon, Goodnews, Indian, Cripple, Jacksmith, Arolik, and Kanektok rivers. The Kanektok, Arolik, and Goodnews rivers are the major drainages of this area and are described in more detail in other Refuge publications (USFWS 1990). Other drainages included in this study are the Eek River to the north and the Osviak River to the south draining into Bristol Bay.

The general consensus is that the Central Yup'ik people and their ancestors have consistently occupied this area for at least 2,000 years (Dumond 1987). The first U.S. Census of the region was conducted in 1880, when it was determined that the lower Kuskokwim Bay was home to at least 878 people. At that time the local population was distributed between at least 12 different communities scattered along the coast from the Eek River to Cape Newenham (Rollins 1978). In 2000, there were four communities with a combined population totalling 1,106 persons in the area. The two villages from which these elders currently hail are Goodnews Bay and Quinhagak.

The community of Goodnews Bay is located at the mouth of the Goodnews River on the northeast shore of Goodnews Bay, a small, sheltered bay along the southern coastline of the larger Kuskokwim Bay (Figure 2). The first census for the village at the mouth of the Goodnews River, Mumtrak, was recorded in 1880. In that year and in 1890, the village's population was 162 (Rollins 1978). The present village, Goodnews Bay, was founded in the early 1930s with the establishment of a BIA school and post office located 0.2 miles from the village of Mumtrak. The present-day population of Goodnews Bay came from the villages of Mumtrak and Kinegnak, located approximately 35 miles to the south (Payne et al. 1982).



The village of Goodnews Bay. USFWS photo



The village of Quinhagak lies on the coast of Kuskokwim Bay. USFWS photo

Quinhagak lies on the southern coast of Kuskokwim Bay at the mouth of the Kanektok River (Figure 3). Quinhagak's origin predates historic contact. Historically, it has been one of the largest communities along the Kuskokwim Bay. Quinhagak became a focus for the area's population when the Moravian Church established a school there in late 1903. The population of Quinhagak has grown steadily according to available census figures. From its first enumeration in 1880 Quinhagak grew from a community of 83 persons in six houses, to a community



The lower Middle Fork of the Goodnews River. Big Beluga Mountain and Kuskokwim Bay are in the background. USFWS photo

of 427 persons residing in 97 households by 1982 (Wolfe 1984:110–112). The 2000 U.S. Census established that the community of Quinhagak had 555 residents living in 137 households.

Information on fish species distribution for this study area is available from the ADF&G's Anadromous Waters Catalog (Johnson et al. 2004a and 2004b), specific salmon escapement monitoring projects (Estensen and Diesinger 2003; and Linderman 2005a and 2005b; Ward et al. 2003), and from other studies conducted on nonsalmon species (Adams 1996; Alt 1976; Gwinn and Reynolds 2005; Lisac 2002, 2003, 2004 and 2006; Lisac and MacDonald 1993, 1995, 1996, 1997 and 1998; MacDonald 1993 and 1996; MacDonald and Lisac 1995; Wagner 1991). Although species distribution is better documented for the rivers and lakes in Kanektok, Arolik, and Goodnews river watersheds than for the smaller watersheds, it is likely to be similar throughout this study area.

Six species of salmon spawn and rear in this area: Chinook *Oncorhynchus tshawytscha*, sockeye *O. nerka*, chum *O. keta*, pink *O. gorbuscha*, and coho *O. kisutch* salmon and rainbow trout *O. mykiss*. Other species that occur throughout these drainages include Dolly Varden *Salvelinus malma*, Arctic char *S. alpinus*, lake trout *S. namaycush*, Arctic grayling *Thymallus arcticus*, rainbow smelt *Osmerus mordax*, burbot *Lota lota*, Bering cisco *Coregonus laurettae*, least cisco *C. sardinella*, round whitefish *Prosopium cylindraceum*, pigmy whitefish *P. coulteri*, northern pike *Esox lucius*, and Alaska blackfish *Dallia pectoralis*. Other species which may either be incidental visitors or are poorly documented, include three other whitefish species *Coregonus* spp., inconnu (sheefish) *Stenodus leucichthys*, and three other smelt species (eulachon *Thaleichthys pacificus*, capelin *Mal-*



Nonsalmon species such as these round whitefish and Dolly Varden are harvested from fall through spring by southwest Alaska residents. ADF&G photo



Subsistence fishing camp at the mouth of the Osviak River (circa 1970). Salmon has long been the primary subsistence resource for the residents of southwest Alaska. USFWS photo

lotus villosus and pond smelt *Hypomesus olidus*). Other marine species such as starry flounder *Platichthys stellatus*, yellow fin sole *Limanda aspera*, Pacific cod *Gadus macrocephalus*, saffron cod *Eleginu gracilis*, and Pacific tomcod *Microgadus proximus* also inhabit the nearshore waters and are available for subsistence harvest.

Dolly Varden, round whitefish, Bering cisco, and rainbow smelt are anadromous; that is they spend time at sea before returning to freshwater to spawn. Unlike the anadromous Pacific salmon, these fish are iteroparous, or capable of reproducing more than once throughout their life span. Rainbow trout in this region are near the northern extent of their range in North America, and are considered to be solely the nonanadromous, resident life history form. The other species mentioned above have nonresident life histories.

Subsistence fishing occurs throughout the Kanektok and Goodnews drainages, in the coastal waters off Quinhagak, and within Goodnews Bay. Subsistence-caught salmon make an important contribution to the annual diet of residents from the three Kuskokwim Bay villages; Quinhagak, Goodnews, and Platinum. The most recent baseline subsistence survey conducted in this study area was in 1982 in the village of Quinhagak (Wolfe et al. 1984). The Community Profile Database (CPDB) cites this work for providing an estimate of a subsistence salmon harvest of 22,499 in Quinhagak during 1982 (Scott et al. 2001). The ADF&G has quantified subsistence salmon harvests by residents of these villages using a seasonal calendar and individual household interviews (ADF&G 2001*b*; Burkey et al. 2001; Fall and Shanks 2000). The total number of all salmon harvested has ranged from a high of 19,012 in 1990 to a low of 7,276 in 1996. The five-year average salmon harvest has declined from nearly 14,000 (1989 to 1993) to the most recent five-year average of under 10,000 (1999 to 2004). By species, the annual subsistence harvests for the three communities have averaged 4,245 Chinook, 1,969 sockeye, 1,710 chum, and 3,052 coho salmon for the years 1989 through 2004 (Table 1) (Caylor 2006).

Table 1. Subsistence Harvest of Salmon by Kuskokwim Bay Residents in Quinhagak, Goodnews Bay, and Platinum, 1989 to 2004.

Year	Households Contacted	Chinook	Sockeye	Coho	Chum	Pink	Total Salmon
1989	211	4,010	1,493	4,694	2,352	NA	12,550
1990	204	6,552	3,074	5,820	3,566	NA	19,012
1991	204	4,610	3,054	5,060	1,743	NA	14,466
1992	194	3,821	2,090	4,310	2,838	NA	13,060
1993	193	4,076	1,917	3,378	1,196	NA	10,567
1994	192	4,779	1,770	3,251	1,923	NA	11,723
1995	191	3,629	826	2,867	841	NA	8,162
1996	193	3,490	818	1,819	1,149	NA	7,276
1997	199	3,882	1,165	1,661	733	NA	7,440
1998	209	4,758	1,998	2,034	1,763	NA	10,553
1999	204	4,038	2,511	2,603	2,092	NA	11,243
2000	200	3,809	2,546	1,605	1,276	NA	9,236
2001	208	3,818	1,888	2,141	973	NA	8,820
2002	210	3,332	1,905	1,396	2,246	NA	8,879
2003	223	4,635	2,405	3,366	1,305	NA	11,711
2004	227	4,680	2,046	2,826	1,369	NA	10,921
Avg.	204	4,245	1,969	3,052	1,710		10,976

Subsistence use of nonsalmon fish species for the Kuskokwim Bay communities is not well quantified compared to the salmon discussion above. The CPDB quantifies the annual subsistence harvest of nonsalmon species for the village of Quinhagak as 78,171 individual fish. All households surveyed in Quinhagak (100%) in 1982 reported using “trouts” and had a combined estimated harvest of 24,247 fish (Wolfe et al. 1984; ADF&G 2001). Based on more recent reports by local residents and Refuge staff, this harvest is composed primarily of Dolly Varden. The remaining nonsalmon catch likely consists of rainbow smelt, rainbow trout, and Arctic grayling.

METHODS

The Togiak National Wildlife Refuge collaborated with the Office of Subsistence Management, USFWS; the Oral History Department, UAF; and the Division of Subsistence, ADF&G, in designing this study methodology, with support from the BBNA, Association of Village Council Presidents (AVCP), the Manokotak Tribal Council, the Togiak Traditional Council, the Goodnews Bay Village Council, and the Native Village of Quinhagak.

Key informant interviews were used to reflect a species specific focus on the region's subsistence fishery. All aspects of this project were conducted in accordance with the standards set forth by the Principles for the Conduct of Research in the Arctic (<http://ankn.uaf.edu/IKS/conduct.html>). The Oral History Department of UAF and OSM provided interview and mapping training to locally hired Refuge Information Technicians (RITs). The RITs worked with village councils to identify elders (key respondents) to be interviewed with knowledge of resources within and adjacent to the Togiak Refuge. Respondents included two elders each from the villages of Quinhagak and Goodnews Bay. A graduate student was hired to oversee interview transcription, and text and spacial database development. The Division of Subsistence, ADF&G staff assisted in compiling information in a summary report format. All project components were overseen by Refuge staff.

Data for this study were compiled from three sources: (1) recently conducted interviews of elders from Quinhagak, (2) interviews of the newly selected respondents from Quinhagak and Goodnews Bay, and (3) previous efforts that were identified as containing information possibly relevant to this project's objectives (Objective 1). These other sources included place name maps for the Kanektok (Togiak Refuge files) and Togiak River (Gross 1991); the BIA Alaska Native Claims Settlement Act (ANCSA) 14(h)(1) Program interview collection and associated maps; Bristol Environmental Services place-names project (<http://bristolbayonline.com/bbplacenames/>); and the extensive local knowledge of one of the project RITs, Peter Abraham of Togiak. A detailed list of interviews conducted throughout the study area was received from the BIA ANCSA 14(h)(1). The texts of those interviews were reviewed for content relating to study objectives.

Evaluation of 2002 and 2003 Interview Data

Two elders from Quinhagak, Elsie Small and Kenneth Cleveland, had been interviewed for another project, and those interviews were included in this final project analysis. Although the earlier study collected TEK on the seasonal rounds of subsistence activities concerning all subsistence resources (LaVine and Lisac 2003), only data from their interviews relating to this current study's objectives were evaluated and included. Qualitative analysis of all project interviews is discussed below.

Identification of Project Informants

In cooperation with the village councils, an initial six elders (five men and one woman) were identified based on their local knowledge and regional residency from birth. Of those six elders, five were successfully contacted for preliminary interviews. Each person was given an overview of the project and an informed consent and release form to sign. After preliminary

interviews were conducted four elders were chosen to continue with the study, based on their extensive knowledge and experience in subsistence fisheries. The four selected respondents were Henry Mathews and Paul Jones from Quinhagak and Bavilla Merritt and Charlie Chingliak from Goodnews Bay. These four, along with the two elders from the earlier project, provided all the interview data included in this project.

The Interview Process

All interviews were conducted in Yup'ik. This was a necessary measure because the project respondents spoke little or no English. Conducting the interviews in Yup'ik allowed the identification of traditional taxonomy and place names discussed during the project. These were documented on maps, checklists, and project databases. The information shared is preserved on videotape and audio files in the original Yup'ik, as well as in text as English transcriptions. This will allow future generations of Yup'ik as well as non-Yup'ik scholars, researchers, resource managers, and interested individuals to access other data not included in the analysis relevant to this project's objectives.

Interviews followed specific guidelines. Several training sessions for the RITs were conducted in order to familiarize staff with the interview process. These sessions addressed the use of the questionnaire and checklist, pre- and post-interview paperwork including the consent and



Refuge Information Technician Pete Abraham (L) and Interpreter/Liaison Jon Dyasuk (R) interview Henry Matthews in Quinhagak. USFWS photo

release form, the background information sheet, and the context statement. Also covered in these sessions was appropriate use of a fish photo identification manual, the mapping key, and the transcription process. All these guidelines and documents were covered and included in an Interview Protocol Manual and Task List compiled specifically for the training sessions (Lisac and La Vine 2004) (Appendix).

The interviews were conducted in three phases: (1) the pre-interview; (2) an interview in which the interviewer asked a series of open-ended statements and questions about the respondents' life histories and seasonal round of activities; and, (3) follow-up interview(s) in which the focus was on species-specific topics. During all phases of the interviews, a set of United States Geological Survey (USGS) 1:250,000 topographic maps was used for each respondent to indicate the locations of subsistence resources, subsistence resource use areas, seasonal and permanent residences, and place names. The information included on these maps was digitized and converted into GIS project layers using ArcView software.

A variety of media was employed to record information gathered in all interviews. All interviews were both videotaped and recorded on audio memory-stick. Each interview is available in the following formats:

- The original digital video recordings
- A digital audio memory-stick recording as an electronic file
- Translated text file in the AskSam text database
- Maps containing geographic information in the ArcView spatial database

Phase I—The Pre-interview

During the pre-interview, the interviewer discussed the purpose of this project and the sequence of events to follow. The checklist and questionnaire to be used during the interview were provided to the respondents and discussed. A pre-interview background information sheet was completed along with the signing of the consent and release form. Compensation for participation in this project was also discussed during the pre-interview.

Phase II—Interview

The interviews were conducted as a review of a person's life within the setting of the seasonal round of subsistence activities. The questionnaire outline was designed to direct discussion to determine locations and distribution of subsistence fish species, seasonal subsistence use locations, subsistence methods and means, and observations of environmental or physical habitat changes. The interviewers emphasized the comparison of subsistence activities carried out today with those from the previous life stages. The species checklist and questionnaire were used to guide the interviewer and focus the life story descriptions on more species-specific questions. The interviewer used the checklist to keep track of information covered during the interviews and to direct potential follow-up interviews.

To ensure that fish species were correctly and consistently identified throughout the data-gathering process, a fish-species photographic key was used at each stage of the interview process. The respondent was asked to provide the local or Yup'ik name for the species being discussed. These names were recorded on the checklist and project maps.

Phase III—Follow-up interviews

The follow-up interviews sought to gather species-specific information not extensively covered during the Phase II interviews. They were designed based on data gaps identified through the questionnaire and checklist completed throughout Phases I and II of the interview process. If the respondent expressed willingness to share knowledge about a particular species, the interviewers conducted follow-up interviews to ask more specific questions related to those topics, such as species and environmental factors. For example, if during Phase I a respondent talked about coho salmon, the interviewer asked for specific information about spawning habits, harvest methods, and distribution and changes observed over time.

The Transcription Process

All interviews were transcribed from Yup'ik to English by either RITs or by a contracted interpreter. Most of this work was performed by the same RITs who conducted interviews and mapping sessions. Once an interview was transcribed, it was reviewed for accuracy by another Yup'ik speaker (RIT). At that time corrections were suggested and a final edit process was performed. The final edit and transcription was conducted by a non-Yup'ik speaker and required extensive collaboration with the transcriber. Final spelling of all Yup'ik words remaining in the translation was left to the senior RIT, who referenced the Yup'ik Eskimo Dictionary (Jacobson 1984) before approving the final draft of an interview.

Data Analysis and Presentation

The interview information has been organized by time period, species observations, and observations of the physical and climatic environment. The time periods are primarily divided into 25-year increments beginning in 1916 with the birth of the eldest participant. Technology and moments of economic change were used as markers to date the elders' memories because in most cases, dates were not provided during the interviews. Interviews were loosely structured around "stages" in each person's life and therefore it was difficult to be exact when it came to determining a year for specific activities.

Included for each species are the harvest practices (gear type, level, and season), preservation and processing, traditional taxonomy, life history, population trend, distribution, and ecological relationships. A summary of Western science descriptions and life history for each species is included along with the local and traditional knowledge from project elders. In reviewing the interviews, a key focus is to look for patterns in reports of changes in species abundance, distribution, or uses, and for potential causes for these observed changes. This information is lacking for the lower Kuskokwim Bay area and should help Federal subsistence management gain a general understanding of the degree to which these resources have been exploited and the relative importance of these species to the users.

Translated interviews were converted to standard text format and stored using the database software AskSam, following ADF&G standard protocols (Coiley-Kenner 2002). This database allows key-word indexing by assigned searchable fields or by searching for individual words in the text. The fields used were modeled after the "From Neqa to Tepa" organizational logic (ADF&G 2001a), with some minor adjustments relevant to this specific study. The key-word-and-field format provides the framework for data analysis. Keeping in mind the potential for

future use of this database by researchers and other interested persons, attempts have been made to include keywords that anticipate a greater range of research interest than simply subsistence fisheries. A copy of this completed database may accompany this final report or can be requested from the principal investigators.

The spacial database incorporated information gathered from the maps developed by each respondent from this study, geographically referenced information contained in the transcribed interviews, and other sources. Any reference to a geographic location contained in the text interview was combined with the physical mapping information and transferred to the spacial database. Other sources incorporated into the spacial database for this project include: place names on the Kanektok River from Refuge files; a Togiak place names map containing place names around the Togiak River, Cape Newenham, Goodnews Bay, the Arolik River, and the Kanektok River (Gross 1991); Bristol Environmental Services place-names project (<http://bristolbayonline.com/framesetup.asp>); and the BIA's maps of Historical Sites and Cemeteries made for ANCSA 14(h)(1) research. Mapping and geographic data are displayed as GIS layers. This information can be retrieved and displayed by species, geographic area, or respondent. Sample maps are presented for key species information. A copy of this completed database be requested from the principal investigator.

CONTRIBUTING ELDERS

Interviews from a total of six elders are the source material for this project (Table 2). Two elders were interviewed in 2002 (LaVine and Lisac 2003), and four elders were interviewed in 2004 and 2005. Contributing elders are Kenneth Cleveland, Paul Jones, Henry Matthews, and Elsie Small from Quinhagak; and Charlie Chingliak and Bavilla Merritt from Goodnews Bay. Although the elders may have spent a significant portion of their adult lives in Quinhagak and Goodnews Bay, three were born into communities that no longer exist as populated settlements (Apokak and Osviak) and all have traveled extensively throughout the region. Collectively, their local knowledge covers the land from both sides of the Kuskokwim River just beyond Bethel and down to Nushagak Bay.

Table 2. Name, residence and dates of interview by respondent, 2002–2004.

Name of Interviewee	Community of Residence	Dates Interviewed
Henry Matthews (b. 1916)	Quinhagak	February 4, 2004 March 10, 2004
Elsie Small (b. 1927)	Quinhagak	June 21, 2002 September 4, 2002 September 5, 2002 September 6, 2002
Kenneth Cleveland (b. 1920)	Quinhagak	June 18, 2002 August 9, 2002 September 4, 2002 September 5, 2002 September 6, 2002
Paul Jones (b. 1923)	Quinhagak	February 3, 2004 February 4, 2004 March 10, 2004
Bavilla Merritt (b. 1939)	Goodnews Bay	February 18, 2004 February 19, 2004 March 4, 2004
Charlie Chingliak (b. 1932)	Goodnews Bay	February 18, 2004 February 19, 2004

All elders were selected by their communities to participate in this project because of the extensive knowledge each held of subsistence fisheries and the local environment. Although hunting had begun at various ages for the project participants, all of them began to participate in subsistence fishing activities while still very young. At an early age these men and the woman learned how and when to harvest fish from their parents, grandparents, and community elders. This information was applied in their own lives to care for their own families, confirming and adding to a growing body of knowledge through careful observation and personal experience. Some carried their expertise and understanding of the local fisheries and environment into the commercial sector with their work for canneries or on commercial fishing vessels.

The annual rounds of subsistence activities saw an ebb and flow of targeted resources depending on the season, but fish were pursued year round. All the project elders possessed memories of harvesting and processing fish in winter, spring, summer, and fall, and if able, they continue to participate in these efforts today.

Information from the interviews is arranged into four separate sections: Participant Biographies; Continuity and Change of Subsistence Fishing Practices and Knowledge in the Lower Kuskokwim Bay; Species Descriptions; and the Changes in the Physical Environment and Climate.

Biographies of Participants

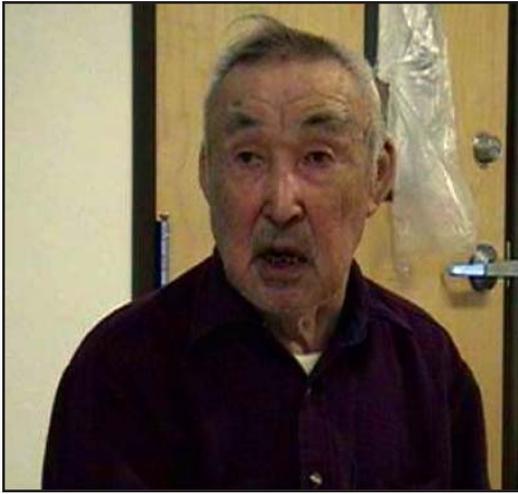
Kenneth Cleveland, Quinhagak

Kenneth Cleveland was born July 21, 1920, in *Aprukaar* (Apokak), a community along the south shore of the mouth of the Kuskokwim. This community was abandoned after its freshwater source dried up due to flooding and erosion. His family moved to Eek and eventually to Quinhagak, where he currently resides. Kenneth recalls a time when people used bows and arrows (*uoluret*) and throwing spears (*enusaarpiit*) with three prongs to meet their subsistence needs. He has spent his life in the region, living off the land, traveling the length of the coastline and up streams and rivers.



Paul Jones, Quinhagak

Paul Jones was born January 4, 1923, in Quinhagak. At the writing of this report he was living in Quinhagak. Paul's early childhood was spent in spring, summer, and winter camps mainly on the Kanektok and Arolik rivers with his parents before they moved to Quinhagak. Paul has traveled extensively around the region, from up the Kuskokwim to Bethel for supplies, to Bristol Bay (Togiak and Dillingham) for employment. His subsistence activities have been concentrated in the Kuskokwim, Kanektok, and Arolik River drainages, and Kuskokwim Bay.



Henry Matthews, Quinhagak

Henry Matthews was born January 1, 1916, in *Apru-kaar* (Apokak), the same community as Kenneth Cleveland. After the freshwater source for the village dried up, many community members moved to Eek, but Henry and his mother moved to Quinhagak, where he lives today. Henry learned to hunt after the move to Quinhagak and has been an avid subsistence practitioner ever since. Henry worked in the fur trade and the canneries through World War II, eventually becoming a commercial fisherman later in life.

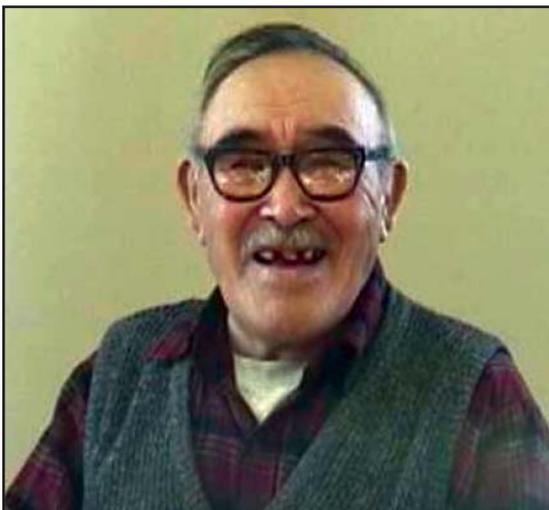
Elsie Small, Quinhagak

Elsie Small was born December 4, 1927, in the village of Quinhagak where she still lives today. Elsie spent the majority of her life being a wife and mother, providing for her family by practicing the traditional subsistence way of life and remembering the wisdom of her elders. Her husband taught her to drive boats, ATVs, and snowmachines. After his loss she has managed to travel extensively throughout the region on her “snow-go” and still enjoys participating in subsistence activities with the aid of her grandchildren.



Charlie Chingliak, Goodnews Bay

Charlie Chingliak was born December 10, 1932, in Osviak village at the mouth of the Osviak River on the Bristol Bay side of Cape Newenham. In his early life, Charlie traveled with his family practicing the subsistence way of life from Hagemester Strait, around the Cape and along the coastline. His family resided in Kineganak (Chagvan Bay) periodically. They moved to Platinum, and finally settled in Goodnews Bay, where he currently resides. In his adult life Charlie was able to find seasonal employment with the canneries on Bristol Bay, and later as a commercial fisherman out of Togiak. He also joined the U.S. Army and spent time training in Anchorage and other locations throughout the state.





Bavilla Merritt, Goodnews Bay

Bavilla Merritt was born January 23, 1939, alongside the Goodnews River. He spent most of his early life subsisting with his family at a number of semi-permanent settlements along the Goodnews River drainage. Although eventually the family moved to Goodnews Bay village, they continued moving to temporary spring and summer camps. Bavilla became a provider for his family at a very early age and still spends much of his time hunting and fishing.

CONTINUITY AND CHANGE IN THE SEASONAL ROUND OF SUBSISTENCE HARVEST AND FISHING ACTIVITY OVER TIME (1916–2004)

Although participation in a cash economy is a fact of life for people living in rural Alaska, it has not changed the importance of the subsistence way of life for the people of the lower Kuskokwim Bay. The annual subsistence harvest of fish in the area has followed an unchanging pattern of harvest sequencing since the 1920s. Harvest technology, preservation and processing methods, and harvest quantities have changed, but in general, most fish species eaten 80 years ago are still harvested and eaten today.

The greatest change observed by project participants has occurred in the area of the technology affecting method and means of harvest, transportation, and tools for processing subsistence catches. Many innovations have improved the efficiency and speed by which people exploit resources. Effects of this change can be seen in a reduction of seasonal camp use in favor of pursuing resources from a permanent home base, a reduction in the harvest of particular species due to decreased need, and an increase in the take of other species due to more efficient harvest methods.

The following sections illustrate these observations of continuity and change by examining the technological and economic influences throughout the life of the elders against the annual subsistence cycle. Information will be summarized in 25-year increments beginning in 1916 with the birth of the eldest participant, Henry Matthews. Knowledge shared by these elders helps to illuminate a period up to the present with a focus on subsistence harvests and the fish that were important to them. A detailed description of the seasonal round of subsistence activities for the region during the first time period serves as the basis for charting change and continuity in the following time periods.



*Spawned-out sockeye salmon (sayak or sayiit) are harvested in the fall.
USFWS photo*



Seasonal camp and fish cache along the Kuskokwim Bay coast. USFWS photo

1916–1929 Bow and Arrows, Spears, Reindeer Herding and Dog Teams, Seasonal Camps, Fur Trade

This time period is characterized by the continued use of traditional harvesting technology such as the bow and arrow, spears, and the use of dog teams and kayaks for transportation and hunting activities. It also includes a discussion of the early economic opportunities of the region; reindeer herding and the fur trade. Subsistence activities during this time were focused on following resource abundance to seasonal camps. As modes for transport were limited, people spent large portions of the year in nonpermanent settlements.

This section is primarily composed from the memories and knowledge provided by three elders who came into awareness (the time where memories begin) before 1930: Henry Matthews, born in Apokak in 1916; Kenneth Cleveland, born in Apokak in 1920, and Paul Jones, born in Quinhagak in 1923. All three men were living in Quinhagak when they were interviewed. Information from Elsie Small (b. 1930) and Bavilla Merritt (b. 1939) provides context for the duration of use of early subsistence-harvest technology. Knowledge shared in this project also reflects the knowledge obtained from community elders and family members who taught and shared knowledge with all the project informants.

The use of spears and bow and arrows existed in the memories of all three men. Henry Matthews remembered spearing smelt and Bering cisco through the ice during the winter. By the time he was old enough to participate in seal hunts in his own kayak (probably not until the 1930s) he and the men were using guns and harpoons. At Apokak, when Kenneth was a small child he observed hunting with bows and arrows, throwing boards, and spears with three

prongs, which were used to harvest pike. He said that people stopped using bows and arrows and fish spears once they moved to Eek (in the early to mid 1930s). Elsie Small reported that her earliest memories involved seeing some people use bow and arrows, but none after that. Bavilla Merritt, however, the youngest participant, recalled people still using fish spears on occasion into the early 1950s.

Through 1929, people were using dog teams and some even had reindeer for transportation during the winter. On open water, most people used kayaks and oar boats, which they poled upriver. Small boats with sails were also in use. Going against the wind, these boats were fast. The sail was lowered, allowing the boat to travel in a criss-crossing movement whether the tide was high or low. In this way, bigger boats could go quite quickly in windy weather. Able to hold whole families, these big boats sometimes moved people from spring muskrat trapping camps to the village and to salmon or “fish” camps, from where salmon was harvested and processed. Prior to this time long migrations by dog team, foot, or kayak were required.

In the early lives of elders (from this time period; 1916–1929, and into the next; 1930–1954), families living in the study area followed a complex seasonal round of subsistence harvest, which differed slightly depending on the specific environment on which each community or family depended. Apokak was located on a back slough near the mouth of the Kuskokwim River. People there didn’t move about quite as much as those on the Goodnews and Kanektok rivers. From Apokak in springtime, spotted, ringed, and bearded seals, and birds and eggs were hunted from kayaks until the month of June, when Chinook salmon arrived at the mouths of some rivers. Occasionally, belugas were harvested. Traps were used to harvest furbearers. Women began harvesting edible plants as they were revealed by the melting snow in order to prepare *qayusat* (salmon roe and plant soup), and *qamiqurllut* (dried and smoked Chinook heads from the previous season) was also prepared.

Most spring harvesting activities were characterized by community dispersal to seasonal camps spread out along the Kanektok and Goodnews River drainages, where people fished with nets or spears through the ice, occasionally taking seals, until the migratory birds arrived and could be harvested along with their eggs. Some families went towards the mountains or to shore-based camps to trap parka squirrels. Often, muskrats and other furbearers were targeted as well. During this time women put out snares to catch ptarmigan, while children harvested fish from creeks with small nets. Outboard motors were scarce and kayaks and boats had to be poled or pulled upriver and portaged around rapids. Smelt were harvested from the rivers, and women tended them constantly as the fish were braided, dried, smoked, and stored, a process taking many days. At other sites, Pacific herring and capelin arrived. These too were braided with grass and hung to dry. Families were spread out while at spring camps, rarely seeing other people.

For some families, spring camp was also summer camp, where they spent the season putting up salmon. For others, summer was a return to more permanent villages, such as Goodnews Bay and Quinhagak. Elsie and her family, after spring camp but before migrating birds arrived, returned to Quinhagak to harvest and preserve salmon, described as “putting up fish.” The trip took a night or two. The elderly drifted down the river in boats or kayaks, pushing with a pole or oar. Women traveled by walking alongside the river. Those who were reindeer herders also returned to the villages simply by walking across the tundra or up the coastline. Families returned to Goodnews Bay in June to harvest Chinook and other species of salmon throughout the summer. Salmon fishing began with the arrival of the first Chinook, which



Parka squirrels are hunted and dried at traditional, seasonal camps. This camp is located at Eek Lake north of the Kanektok River drainage. September 2002, USFWS photo

were then caught one or two at a time in nets. The nets in use at this time were not designed well for large harvests of Chinook at one time. Next, sockeye were gathered from the nets, then chum salmon overlapping the sockeye run. Coho arrived in August, mixed with pink salmon. Harvesting sites on the Goodnews River were generally in the lower river near the mouth and Goodnews Bay. Wood was collected for smoking salmon, and salmon hanging in nets on the muddy flats at low tide were gathered. Women braided grass backpacks to carry salmon, and made salmon skins into garments.

As summer transformed into fall, migratory birds were hunted upriver and down the coast. Brown bear were hunted during this time as well as in the spring. Some people traveled upriver and put up fish for winter use. Some stayed upriver all winter, often in sod dwellings. Coho and spawned-out sockeye salmon were harvested for drying. Dolly Varden, grayling, and whitefish were harvested concurrently, some stored in ground caches. As wildlife got scarce, families stayed close to the river, harvesting snowshoe hare as well as fish. Tomcod was sometimes harvested at *Ciniq*, near the mouth of Warehouse Creek (north of the Kanektok River), during ice fishing.

Moose were just beginning to populate the wider area during this period (1916–1929) and, although rare, occasionally one was taken. Reindeer were in the area but they were domestic and could not be hunted. The Apokak area was good blackfish habitat and many of these fish were

harvested through the fall and into winter. Other fish harvested included smelt and Bering cisco. Some people used spears to harvest fish. In most communities of the lower Kuskokwim, winter travel was still likely to happen on sleds pulled by dogs, although Paul Jones's family used two reindeer for this purpose. Camping for two and three days was not unusual. In winter, fishing, hunting, and trapping occurred as often as possible. Boys traveling with their fathers, first harvested blackfish in fish traps in preparation for longer hunting trips.

As the days slowly grew warmer, fish such as Bering cisco and Dolly Varden from the main Goodnews River were the primary foods eaten. Fish such as smelt were jigged all winter long at some locations. Seals and ptarmigan were also hunted.

1930–1954 Rifles, Fur Trade Continues, Reindeer Herds Disappear, Cannery Work, Mining, Outboard Motors, and Establishment of Permanent Year-Round Communities.

The period from 1930 to 1954 was marked by extensive use of the rifle, a growing reliance on the outboard motor, and growing diversity in economic opportunity while a subsistence way of life continued. All six elders contributed to the information included in this section and from this time on. Elsie Small was born in Quinhagak in 1927, and her memories begin with the new decade. Charlie Chingliak, originally from Osviak, was born in 1932, and Bavilla Merritt, the project's youngest informant, was born in 1939. Both Charlie and Bavilla live in Goodnews Bay.

This time period is defined by great influences from change in the technology used for subsistence and travel as well as greater options and local involvement in the cash economy. Even so, innovation occurred slowly for the people outside the major flow of the Kuskokwim River. Bavilla Merritt reported that Chinook salmon coming around Cape Newenham reached the Kuskokwim Bay first because that area has a stronger current than other rivers to the south. Goodnews Bay catches fish about a week later, although it is closer to the Cape. This observation provides an interesting analogy for technological advances that occurred in the region. Like the Chinook that start their return up the Kanektok and the Goodnews rivers a week or so behind those traveling up the Kuskokwim, it seems that technology was slow to arrive in the lower Kuskokwim Bay communities as well, in part because of the "fast current" of the big river just north of them. Bethel had a fast socio-economic current to match that of the river it was on, being a regional hub, like Dillingham to the south.

According to Oswalt (1990), outboard motors in the Bethel area were in use by white settlers by 1914, and were gaining in popularity with local Natives at the end of World War I. Few of the elders interviewed for this project had much contact with the Bethel area during their youth. Even into adulthood, with regard to economic or trading activity, many stuck close to their place of birth. They preferred using the trading posts and the eventual economic opportunities that local establishments provided them, at least until the 1940s. By the time the oldest project elders reached their mid to late teens, around 1930, more people from their region could afford to purchase outboard motors and these were seen more frequently from this time on. It was at Eek that Kenneth first saw small boats with sails and simple outboard motors. This would have been about 1935 or a little bit later and doesn't mean that these innovations weren't in use earlier—they just weren't in use or as evident at Apokak. Eek might well have been a larger settlement and been somewhat closer to Bethel. Henry Matthews reported having an outboard motor when he was "young," probably around the mid to late 1930s as an older teen and into his early adulthood. Henry was participating in the fur trade at this time and was the only

one to report traveling into Bethel to sell furs before the summer salmon subsistence harvest. Although he was the first in the project to report having an outboard motor so early, this was still a good 10 years or so behind Bethel, and it wasn't until much later that any of the other project participants from Goodnews or Quinhagak had their own outboards.

The communities of the Lower Kuskokwim Bay began to participate in the commercial fishing industry during this time period (1930–1954). Langdon identifies Native involvement as occurring from the 1940s onward (2002:114), but Wolfe et al. (1984) report that Quinhagak men didn't demonstrate much involvement in commercial fishing until the 1960s. The slight discrepancy between these observations might be bridged by information from the project elders who said they did participate early in commercial fisheries by harvesting fish for the canneries in boats provided by the canneries. Wolfe et al. (1984) may have been reporting on local boat owners applying for commercial fishing licenses. There may also be a distinction between working in the commercial sector of fisheries through cannery work versus the actual harvest and selling of fish. While canneries were in operation in the Bristol Bay region since the turn of the century, local people were not the preferred labor force. It wasn't until the beginning of World War II that canneries employed Bristol Bay Native residents, largely because of a lack in workforce due to the war effort. Some people from Quinhagak traveled down to Ekuk to work the canneries, and those from Goodnews Bay found work in the canneries of the Bristol Bay region as well. The Togiak cannery began operating in the 1950s (Wolfe et al. 1984), but there is no mention of whether it became a significant draw for those people in Quinhagak and Goodnews. Henry Matthews actually began working at a cannery before World War II and stayed for the duration of the war. It was his first paying job before he started commercial salmon fishing in Bristol Bay. Most of the men in our study (including Elsie Small's husband) began to fish commercially as opportunity presented itself. Wolfe et al. (1984) reported no documentation of a commercial fish harvest from Goodnews Bay and Quinhagak before 1960. However, it is possible that some of these individuals commercial fished in Bristol Bay at an earlier time, either on their own or as crew members.

It was during the late 1930s that reindeer herds disappeared from the area. There is no discussion of this in either Van Stone (1968) or Oswalt (1990) that directly pertains to the lower Kuskokwim Bay area. Henkleman and Vitt (1985) reported that more than 600 head of reindeer from Bethel arrived in Quinhagak in the spring of 1906. No other sources provide information on where reindeer herds were located from the lower Kuskokwim Bay down to Dillingham, and yet, many of the interviewed residents from Quinhagak and Goodnews Bay recalled the herds and featured them quite intimately in their memories. Elsie Small had significant experience with reindeer as a young girl older than three (later than 1930), and Paul Jones reported actually working with the deer when he was 15 or 16, in 1938 or 1939. If this is true, those herds disappeared quite quickly, since Oswalt (1990) and Wolfe et al. (1984) reported that the reindeer herds were gone from the area at large by the 1940s.

Bavilla says that prior to the mine at Platinum, which opened around the time of his birth, there were few if any white people around. Those that did live in the area, or passed through, used dog teams, much like the local people. Occasionally one would have an outboard motor, but most people used row boats, sailboats, and kayaks. During the early 1940s, in Bavilla's childhood, if white people came to stay in the area they generally learned the Yup'ik language, ate Yup'ik food, and wore Yup'ik clothing. He said that much later (1940s and 1950s), after airplanes started bringing regular mail service to the area, people began to see a greater influx and variety of commercial goods.

Elsie married at approximately the time when the cannery opened in Togiak, around 1939. Elsie recalled the influx of cash and goods in Quinhagak as people (including her husband) began to work the canneries. It was at this time that some people from Quinhagak became “wealthy.” Wealth was demonstrated by ownership of outboard motors, ability to purchase “white man’s” food and clothing, and other conveniences for hunting, such as rifles and ammunition.

Kenneth remarked often that he became aware and grew up during a time when there was no cash economy. Furs and occasionally fish were later used as a form of currency for basic trade items such as tea, coffee, sugar, flour, rifles, ammunition, pots and pans, some clothing, and occasionally milk. Money didn’t enter into the equation until much later when men (and women) started to work at the canneries or the mine, and eventually started to fish commercially.

Rifles were common from about 1932 onward, according to Charlie Chingliak. When Bavilla was a child many people carried .30-30, .30-06, .25-20 or .22 rifles, and 12-gauge shotguns also began to see wider use.

All these innovations and the introduction to this region of commercial activities and opportunities did little to change the seasonal rounds as described for the first time period.

People were moving from the outlying areas of the region, such as Apokak and Osviak, to the more condensed and permanent communities of Quinhagak, Eek, Togiak, and Goodnews Bay (Apokak was abandoned around 1935, and Osviak in the mid 1940s). They were also using more efficient forms of travel, such as outboard motors and the like, but despite these two changes, all six elders report still traveling year round to seasonal camps through the 1950s and beyond. Bavilla Merritt is younger than the other elders and his early memories begin in about 1945. He remembered families dispersing throughout the area to seasonal camps, sometimes as lone families and other times to semipermanent communities, such as *Qangqairaq* (Lookout Bluff) above the Middle Fork, where quite a few people went to fish and hunt.

Most camps where fish were caught were also chosen for their access to other resources. People in Goodnews Bay were positioned in the spring down by the ocean to catch ptarmigan, ducks, geese, seal, muskrat, and parka squirrel, and they were well positioned to take herring when they arrived. River camps were positioned for the harvest of salmon, and little else, although some elders remember setting traps for blackfish during this time on the flats outside the camps. Whitefish were sometimes taken in nets at this time. Bavilla Merritt recalled Dolly Varden being harvested for dog food before freeze-up, before people returned to Goodnews Bay village for winter. As people obtained outboard motors, fall camping trips for the purpose of harvesting whitefish, Dolly Varden, grayling, and trapping furbearers became day trips. Nukluk Creek could be reached in a day and took only one overnight stay to return to Quinhagak with a load of Dolly Varden. Dried salmon was sold and traded to the minister, for example, who bought fish for his own dog team. It was one of the few ways to get cash income at that time. In fall, men hunted and trapped furbearers with which to trade and sell. During the winter, people could subsist on smelt, Dolly Varden, and other fish caught through the lagoon ice. Dolly Varden was targeted fall, winter, and spring.



Ice fishing on the Goodnews River. 2005, USFWS photo

1955–1979 Commercial Fishing, Effects of Statehood, ANCSA, Snowmachines, Regulations

This time period is characterized by a continuation of the innovations begun in the previous period, and a pronounced involvement in the commercial fishing industry of the region beginning in the 1930–1954 time period. Still, in the descriptions of the elders for this period of their lives, little changed in terms of their seasonal rounds and the species targeted for subsistence harvest. Lenz and Barker (1985) reported that snowmachines didn't appear on the scene in Bethel until the late 1960s. By that time, airplanes had been in greater use in the region since the early 1950s. Snowmachines probably didn't show up in the lower Kuskokwim Bay until a few years later, but by that time, people were engaged in a mixed subsistence-cash economy and could afford to purchase the machines not long after they were introduced to the communities. In 1955 people were still using kayaks, oar boats, and sail boats. Very few local people owned outboard motors although they had been in use in the area for some time. Elsie Small recalled that for a long time there seemed to be only four families in Quinhagak who actually owned outboard motors. Eventually Elsie and her husband were able to afford one. He taught her how to operate the boat, and later, she learned how to drive a snowmachine. Elsie was well known in her community for her independence and her ability to get around on "snow-gos" and four-wheelers.

Paul used a snowmachine to hunt muskrat and squirrel. This sped up the process and it appears he spent less time in spring camp or spring camp activities. But most people still did not abandon their seasonal camps completely. One elder reported that if the snow began to melt before they returned from spring camp, snowmachines would be loaded onto boats and

floated back to the permanent villages or summer camps. Even so, spring camp activities were accomplished more rapidly and most people were ready for Chinook salmon earlier than June. Soon after Chinook season, Paul spent the rest of the summer working in the cannery. His wife subsistence fished and took care of the home. Paul spoke of the effects that modern preservation, such as freezers, were having on subsistence practices. He said they used to preserve fish in pits dug in the ground.

Dolly Varden, coho salmon, and even blackfish were caught in excess in order to feed dogs when people still had teams. Fishing for a dog team was a large portion of the annual subsistence harvest until the late 1960s and early 1970s, when snowmachines came into wider use. The decline in the use of dog teams has resulted in fewer fish being harvested. Better preservation (freezers) and a preference for other species and materials have caused the decline of blackfish and parka squirrel harvests. Kenneth Cleveland commented that with modern technology, such as guns and efficient modes of transportation, more people these days could be a “nukallpianek” (a great provider) unlike in the past, when only a select few had the skills and abilities to consistently bring home meat and other resources for their family and community.

During Bavilla’s mid teens (around 1955) people were catching fish with nets, but did not have the use of “king nets” yet. The nets used at this time were called *sayagcutet* (sockeye salmon nets), and they caught most types of salmon: Chinook, sockeye, chum, and coho. However, the Chinook nets, being made of stronger materials and having a larger mesh, are far more effective at catching fish today. Prior to 1955, people were using nets of less than 25 fathoms and using poles to set them near the mouths of rivers. At this time people were using hooks and spears when fishing through the ice. Some elders saw a parallel with the use of seines to catch Dolly Varden and declining numbers of these fish from 1949 on.

1980–2004 Elderhood, Outside Influence, Sports Fishing

From 1980 through 2004 most of the project participants made the transition from primary providers to taking a secondary role in harvesting and all have noted an increase in outside influence on subsistence resources and harvesting activities. The project elders have continued with their subsistence efforts for as long as they have been able, and the youngest of the six are still quite active.

Kenneth Cleveland discussed becoming an elder after the age of 60 (which he reached in 1980). After that time the subsistence way of life was different from his earlier years. Hunters became more restricted in what they could catch by regulations, hunting seasons, and fishing season openers, but ease of access to resources was assisted by modern technology and modes of transportation. Elders like to participate in subsistence activities, but often need the help of their children and grandchildren as well as of other members of the community. It has been over 10 years since Kenneth has set a steel trap, and for the last five years, he and his wife have not put up fish during salmon season. They rely on their children to provide them with fish. He and his wife will often tend to the fish once they are in the smokehouse, to ensure they are processed correctly. Kenneth likes to go seining for Dolly Varden with his grandchildren or occasionally ice fishing in the winter. He is too old for the heavy work, and usually he needs a helper to do these things.

Nearly all the elders remarked on the growing number of outsiders traveling into the region in order to sport-fish the Goodnews and Kanektok rivers. There is great concern that the health

of the fish is being affected by sportfishing catch-and-release practices, and that most outsiders take little care when it comes to mooring and camping on or around locally known spawning grounds. Catch and release is seen not only as harmful to the fish, but as “playing with food” which is disrespectful to the animal that offers itself for harvest.

Wolfe et al. (1984:315) reported that in Quinhagak and Goodnews Bay there was no discussion of herring or salmon harvesting in the early spring, despite community members’ preparation for commercial efforts. Some study informants testified to the importance of spring camp, where herring were caught (such as Charlie Chingliak when living in Osviak), and Bavilla Merritt said that now sometimes the season’s first Chinook salmon could be caught during herring season out by Security Cove, although he was probably referring to the commercial harvest. But in subsequent interviews, Bavilla included herring as an important subsistence resource before the arrival of Chinook salmon, and he and his family attended spring camp until only recently. There is a good indication that now the commercial and subsistence harvests of herring occur at the same time. In Quinhagak there was reference to the harvest of herring eggs; however, both Elsie and Kenneth said that little herring was actually harvested in Quinhagak.

As an elder, Paul has fish brought to him during the winter time. Young fishermen from the community will catch Dolly Varden, grayling, and rainbow trout by jigging through the ice for the elders to eat. Paul still sets traps for blackfish. Others do too, but the consensus is that blackfish are small around Quinhagak, and their numbers are declining. Paul sets his traps in the fall, near Eek.

SPECIES DESCRIPTIONS

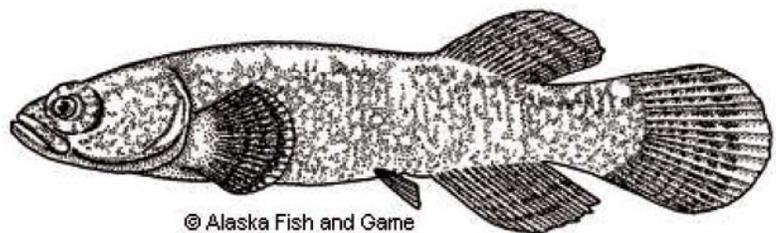
The following life history descriptions of the species encountered during this study are a compilation of information from various sources. Where specific data are used, they have been referenced. Characteristics summarized from the general literature are not attributed to any one source. The references used most often are Morrow (1980), Mecklenburg et al. (2002), and ADF&G's Wildlife Notebook Series (ADF&G 2006). Project reports used are from a variety of agency biologists who have conducted inventory surveys or specific studies primarily of Dolly Varden and rainbow trout. The authors include: Alt (1977), DeCicco (1985), Lisac alone and with others (1992–2006), and MacDonald alone and with others (1993–2000).

The description of subsistence use patterns and areas, traditional taxonomy (Table 3), life history, population trend, distribution, and ecology are a compilation of elder observations by species. These are presented as general observations or by specific geographic area where appropriate (Figures 1 and 2).

Alaska Blackfish

(Dallia pectoralis), *Can'giiq*

The Alaska blackfish is widely distributed throughout western Alaska including this study area (Morrow 1980). They generally inhabit lower elevation ponds, small streams, and lakes, and prefer densely vegetated areas. Alaska blackfish are uniquely adapted to breathe atmospheric oxygen through a modified esophagus capable of gas absorption. This adaptation allows these fish to inhabit stagnant waters or even moist tundra, and to survive periods of extended drought. They cannot survive freezing as stated in popular lore. Spawning occurs during the summer months (May to August), and individual fish may spawn several times throughout the season. No nest building occurs as the fish disperse sticky eggs onto vegetation. Hatching occurs in 8 to 10 days. They primarily feed on aquatic insects and other invertebrates, but also on other fish, including other blackfish. These fish mature at age two or three and have been documented to reach age eight in the Bristol Bay area.



Description of Subsistence Patterns and Use Areas

Blackfish Use Areas

Apokak and Eek: During Kenneth's childhood years, blackfish were harvested from Kuskokwak Creek and small ponds and streams around Apokak, and in the small ponds and streams near Eek. Blackfish were also caught in traps set for river otter, mink, and muskrat. Sometimes it took all day to reach a blackfish trap site by dog team.

Kenneth explained that the blackfish trapping spots he once used around Apokak, his birthplace, do not exist anymore because the lakes are dry and none of them drain into Apokak Slough any longer. Kuskokwak Creek is also dry. Today the Apokak Slough is "getting a hold

Table 3. Common, Scientific and Yup'ik Name Variations for Finfish Used for Subsistence in the Kuskokwim Bay Area.

English Common Name	Other Local Name	Yup'ik Name	Scientific Name
All salmon		<i>Neqpiat, Neqet</i>	
Chinook salmon	king salmon	<i>Taryaqvak</i>	<i>Oncorhynchus tshawytscha</i>
Sockeye salmon	red salmon	<i>Sayak</i>	<i>Oncorhynchus nerka</i>
Chum salmon	dog salmon	<i>Kangitneq, Igalluk</i>	<i>Oncorhynchus keta</i>
Coho salmon	silver salmon	<i>Qakiiyaq</i>	<i>Oncorhynchus kisutch</i>
Pink salmon	humpy	<i>Amaqaayak</i>	<i>Oncorhynchus gorbuscha</i>
Alaska blackfish		<i>Can'giiq</i>	<i>Dallia pectoralis</i>
Burbot	"lush"	<i>Manignaq, Atgiaq</i>	<i>Lota lota</i>
Pacific cod		<i>Manignaalleryak</i>	<i>Godus macrocephalus</i>
Pacific tomcod	Tom cod	<i>Ceturrnaq</i>	<i>Microgadus proximus</i>
Arctic grayling		<i>Culugpauk, Nakrulluqpak</i>	<i>Thymallus arcticus</i>
Northern pike		<i>Cuukvak, Lugruuyak</i>	<i>Esox lucius</i>
Whitefish			
Least cisco		<i>Kassiaq</i>	<i>Coregonus sardinella</i>
Bering cisco		<i>Imarrpinraq, naptaq</i>	<i>Coregonus laurettae</i>
Round whitefish		<i>Caurrutnaq, Uraruq,</i>	<i>Prosopium cylindraceum</i>
Rainbow smelt		<i>Iqalluaq</i>	<i>Osmerus mordax</i>
Capelin		<i>Cikaaq</i>	<i>Mallotus villosus</i>
Dolly Varden	"Togiak trout," "goes out in spring"	<i>Anerrluaq</i>	<i>Salvelinus malma</i>
	"comes in fall"	<i>Iqalluigpik</i>	
	"small Dollies"	<i>Ellugniyaagat igallugpiit</i>	
Arctic char	"lake trout"	<i>Yugyaq</i>	<i>Salvelinus alpinus</i>
Lake trout		<i>Cikignaq</i>	<i>Salvelinus namaycush</i>
Rainbow trout		<i>Talaariq</i>	<i>Oncorhynchus mykiss</i>
Pacific Herring		<i>Iqalluarpak</i>	<i>Clupea harengus pallasii</i>

of" Warehouse Creek, and part of the creek is no longer well defined. Some still set blackfish traps in a creek near Quinhagak.

Quinhagak: Paul said that blackfish were more abundant during his early life than they are now. For people living on the Kanektok River, Ithagsutlek and Tsingigkalik lakes were blackfish-harvesting areas. Currently the existing blackfish are small. He has a blackfish trap at a site south of Eek. He moved his trap there because the local blackfish are small and getting scarce. This may be because Ithagsutlek and Tsingigkalik lakes, where blackfish are harvested, are both drying up.

Kenneth hasn't blackfish-trapped in 10 years. He explained that blackfish are in many of the lakes around Quinhagak and north adjacent to the coast.

Goodnews Bay: Before Bavilla's family moved to Goodnews Bay village, it traveled seasonally from place to place. The places where Bavilla said his father harvested blackfish are the lakes behind the mouth of *Uqvigar* Creek, where the family sometimes stayed in a sod house. Bavilla said "Nobody subsists on them anymore, so nobody knows," and he was not sure if the fish existed at the same places.

Charlie said that blackfish were harvested across the bay on the flats when he first moved to Goodnews in 1947.

Blackfish Gear Type

Apokak: During Kenneth's early life, before the introduction of steel traps, he and his relatives used fish traps targeting mink and muskrat. Some fish traps were set daily to catch fresh blackfish. The term *talluyilret* describes places where fish traps are placed to harvest blackfish, usually in creeks near the outlets of lakes.

Quinhagak: Paul described a childhood experience at Ithagsutlek Lake. One of Elsie's sisters was digging snow pits on the lake, and these pits were full of blackfish. It was in March and, "That's when blackfish start surfacing under the snow."

Goodnews Bay: After moving to Goodnews Bay in 1947, Charlie noticed that blackfish were caught in fish traps placed in small ponds and creeks near Goodnews Bay. He is doubtful that traps are still set locally.



Blackfish were once captured in large quantities during the fall, stored in grass baskets and eaten throughout the winter. USFWS photo



Traps like this were regularly used to catch Alaska blackfish, burbot, and even river otter. USFWS photo

Blackfish Harvest Levels

Apokak: During Kenneth's early life at Apokak, his family seemed to live on blackfish, storing bags full for winter. "We used to try and save them as our annual food supply." At Eek, in his youth, many families set blackfish traps daily. Trapping with his father at Kuskokwak Creek while harvesting furbearers, enough blackfish were caught in a short period of time for their dogs to feast and for the men to eat every evening.

Quinhagak: Paul said that blackfish were more abundant during his early life than they are now, and his parents caught large quantities of blackfish.

Goodnews Bay: Early in the lives of elders, many families harvested blackfish. Bavilla explained that he did not think blackfish had been trapped for a "long time" and he was not sure if they existed at the same places.

Blackfish Season of Harvest

All elders reported harvesting blackfish in the fall, winter, and spring.

Apokak: Kenneth described harvesting blackfish when he was a child while hunting and trapping furbearers, probably from fall to spring.

Quinhagak: During Paul's childhood, his family harvested blackfish from late winter into March. Henry said that around the first freeze in the fall blackfish were at their plumpest. The plumpness of blackfish varied from site to site. Some creeks had good water and produced really good fish. At other places the blackfish were skinny. Blackfish in Kuskokwak Creek were big, extra thick, and meaty. But blackfish harvested locally varied in size. Some were thick boned while others had smaller bones.

Goodnews Bay: During the early lives of elders, blackfish were harvested during winter.

Blackfish Preservation and Processing

Apokak: During Kenneth's early life, blackfish were often eaten fresh raw, raw frozen, or preserved by braiding and drying. His parents stored blackfish in braided grass bags. Sometimes the fish was thawed, but Kenneth thought they tasted very good frozen.

Blackfish Life History

Quinhagak: Paul describes one life stage of blackfish, observed when he was young. During March, blackfish in Ithagsutlek Lake came to the surface of the ice and could be seen by removing the snow on the lake.

Blackfish Abundance

Apokak, Eek, and Quinhagak: Several places where blackfish were once harvested have dried up and elders have moved blackfish traps as far away as Eek. Places once full of blackfish that are no longer used include Kuskokwak Creek, Apokak Slough and surrounding ponds, and Ithagsutlek and Tsingigkalik lakes. Blackfish were more abundant and larger than they are now.

Goodnews Bay: Bavilla thought that blackfish were less abundant now than when he was young, and they seemed smaller, also.

Blackfish Distribution

Apokak and Eek: During the early lives of elders, blackfish distribution included places behind the village of Eek, but generally in lakes and streams near the coast. Blackfish were often harvested on trapping forays, existing in the same areas as otter, for instance, and were caught in the same traps. Areas especially rich with blackfish included Kuskokwak Creek, Apokak Slough, and lakes adjacent to the now abandoned village of Apokak. This latter area was described as particularly excellent blackfish habitat in the past, before many of the lakes and creeks dried up. These blackfish were thought to be larger than those found closer to Quinhagak along the coast.

Quinhagak: During the early lives of several elders, blackfish habitat included Ithagsutlek and Tsingigkalik lakes near Quinhagak.

Goodnews Bay: During Bavilla's childhood his father harvested blackfish in the lakes behind the mouth of *Uqvigar* Creek which runs into Goodnews Bay. When Charlie moved to Goodnews Bay as an adult, blackfish were harvested across Goodnews Bay on the flats in small ponds and creeks. In 2004, elders were not sure if blackfish were still in these areas.

Burbot (*Lota lota*), *Atgiaq*, *Manignaq*

Burbot are the only freshwater cod species in North America and are distributed throughout all of mainland Alaska (Morrow 1980). Burbot inhabit deep freshwater lakes and rivers and are known to move into shallow waters only to feed at night and during the winter spawning season from late January to February. They mature between ages two and seven, depending on the habitat (generally, higher-latitude fish mature later). Burbot migrate to spawning areas composed of clean sand or gravel in water of depths from 1 to 20 meters. Spawning occurs



Burbot, Lota lota, occur throughout the study area. USFWS photo

under the ice as the fish form into a tightly clustered group of milling fish releasing eggs and sperm simultaneously. The fertilized eggs settle to the bottom and hatch in 30 to 70 days, depending on water temperature. These are slow-growing fish that reach a maximum age of 15 to 20 years. Adult burbot are efficient night-time predators and feed almost exclusively on fish, including other burbot.

Description of Subsistence Patterns and Use Areas

Burbot Use Areas

Ciniq: Henry Matthews is from *Ciniq*, an abandoned village at the mouth of Warehouse Creek. In his early life he remembered burbot existing above the village in a place where the alders are now beginning to grow. His stepfather harvested burbot:

My late father-in-law would make huge fish traps to set way up the *Ciniq*. The river becomes narrow way up. That would be where he would set his fish traps in pursuit of burbot. My late stepfather, once when he was tracking otters, he spotted four of them and went towards them but they scurried away, and he saw something black. As he got closer he saw that it was a burbot, and saw there was a hole in the ice, and he looked down into it and saw another one lying at the bottom of the river. He took both of them, but I think the otters may have wiped them out, and since those two men, I haven't heard of anyone else harvesting burbot. But I've heard of people harvesting grayling there. That is grayling country, *Ciniq*, way up that river, but the burbot . . . I think the otters may have killed them all, but it also is so shallow, they may live where it is deeper.

Burbot Gear Type

One elder reported that fish traps were used for capturing burbot in Warehouse Creek north of the Kanektok River.

Burbot Harvest Levels

Several people said that they did not remember harvesting burbot in their lives.

Burbot Season of Harvest

The only observation indicated that burbot were harvested through the ice from late fall to spring.

Burbot Abundance

Burbot were not seen in the use area of these elders from Quinhagak and Goodnews Bay. An early *Ciniq* resident said a couple of burbot were harvested near the village when he was young. Henry stated that he thought the burbot in Warehouse Creek were wiped out by otters.

Burbot Distribution

During elders early lives, burbot were observed near *Ciniq* at the mouth of Warehouse Creek and no place else within the usual fishing sites. Today, burbot exist at Eek and farther north “in the Kuskokwim.”

Goodnews Bay: Charlie stated that burbot did not occur in the Goodnews Bay drainage.



Northern Pike, Cuukvak or Luqruuyak. USFWS photo

Northern Pike (*Esox lucius*), Cuukvak, Luqruuyak

Northern pike (pike) occur throughout the study area and in all watersheds in Alaska that drain to the Bering Sea and Arctic Ocean (Mecklenburg et al. 2002; Morrow 1980). Specifically in this study area, pike are not known to occur in the river systems, but are primarily in isolated (land-locked) clear-water ponds and lakes. They inhabit a variety of depths, but are generally considered to be shallow-water predators. Pike spawn in the spring shortly after the ice has melted off the shallow, weeded, mud-bottom areas. They usually return to the same spawning area each year. Pike do not build a redd or nest, but instead are broadcast spawners, that is, a pair of fish that swim together releasing eggs and milt. The fertilized eggs sink to the vegetation mat on the bottom and hatch anywhere from 5 to 30 days, depending on water temperature. Pike grow fast in the first years of life and are voracious predators on everything from other fish to waterfowl. Pike generally first mature at age three to four.

Description of Subsistence Patterns and Use Areas

Apokak: Henry harvested pike in the Apokak area, where he lived as a child. Pike were abundant there and in the Kuskokwim River, particularly in fall. Pike were harvested with three-pronged throwing spears.

During Kenneth's childhood, pike and other fish were harvested near Eek. Pike exist at Eek "in the Kuskokwim."

Quinhagak: Elders said that there were few pike in the Quinhagak area, and pike were harvested only occasionally. During Elsie's childhood she traveled by boat with her father to the Akulmiut River, near Napakiak on the Kuskokwim River. They harvested pike and other fish from the river.

Goodnews Bay: Bavilla said pike were never seen in the Goodnews Bay area.

Char — Dolly Varden (*Salvelinus malma*), Arctic char (*S. alpinus*) Lake trout (*S. namaycush*)

The three char species, Dolly Varden *Salvelinus malma*, Arctic char *S. alpinus*, and lake trout *S. namaycush*, occur in nearly every drainage of this region. They are all fall spawners, but have different life history strategies and habitat requirements.

The taxonomy of char can be confusing in both the western science world and the Southwest Alaska Yup'ik Eskimo taxonomy (Table 3). Although there has been some debate as to the relationship between Arctic char and Dolly Varden, they have been considered two separate species since the 1980s. In the Togiak area of Bristol Bay, residents have different names for the char species based on external characteristics, meat color and oil content, and area of capture (BBNA and ADF&G 1996). This is especially true for Dolly Varden, which change external appearance based on sex, age (maturity), and time of year. There are at least four local names for these species. Equally confusing is the use of the name "lake trout" which has been used to describe both lake trout (*S. namaycush*) and Arctic char (*S. alpinus*) caught in a lake. Agencies have contributed to the confusion by separating the char species and determining historical harvest levels by including all nonsalmon species as "trouts" in past subsistence surveys, and as "AC/DV" or "char" in sport-fish harvest surveys.

The char most harvested by people in the area is named Dolly Varden, a label used in this section. Arctic char is commonly referred to as "lake trout" or *yugyaq*. Lake trout (*Salvelinus namaycush*) is named *cikignaq*. *Cikignaq* and *yugyaq* are not harvested often in the drainages referred to in this report. Dolly Varden, locally named *anerrluaq* and *iqalluigpik*, are discussed below.

Dolly Varden (*Salvelinus malma*), Anerrluaq, Iqualuipik

Dolly Varden are generally the most numerous and accessible char in the drainages throughout this study area (Lisac 2002, 2003 and 2006). Mature fish primarily spawn in the tributary and main river channels. They do not appear to inhabit the Kuskokwim drainage lakes, instead remaining downstream of the lakes. Young Dolly Varden rear in the river systems and may first go to sea as early as age one to three. Dolly Varden begin their annual migration to the ocean after the river ice breaks in May through June. They spend from 30 to 90 days at sea



Dolly Varden. USFWS photo



Arctic char. USFWS photo



Lake trout. USFWS photo

*The three char species, Dolly Varden (*Salvelinus malma*), Arctic char (*S. alpinus*), and lake trout (*S. namaycush*) occur in nearly every drainage of the lower Kuskokwim Bay region.*

before returning to freshwater throughout July and August to spend the winter. They may not return to their home waters until they mature as early as age four and are ready to spawn. Consequently, the large schools observed in late summer and fished throughout the fall, are composed of immature and non-pawning fish from unknown rivers of origin. After the mature fish have spawned during September and October they descend the tributaries and become mixed with these other fish in overwintering concentrations. These concentrations of mixed stocks are well known by local residents and are annually targeted in the subsistence fishery. Recent work conducted by the Togiak Refuge has documented the travels of Dolly Varden from the Refuge waters to other drainages of the Bering Sea. Fish tagged in the Togiak River have been captured in the Kanektok, Kuskokwim, and Eek rivers. Fish tagged in the Kanektok River have been recaptured in the Kwethluk River (Kuskokwim River tributary) and as far away as Norton Sound, 800 km (480 miles) to the north.

Description of Subsistence Patterns and Use Areas

Dolly Varden Use Areas

Quinhagak: During the early lives of several elders, families traveled upriver in fall and spring to harvest Dolly Varden, round whitefish, and other fish species. Dolly Varden were harvested on the way to squirrel camps in the mountains. After Paul got an outboard motor he traveled to Nukluk Creek, sometimes overnight, harvesting many Dolly Varden.

In modern times, Dolly Varden are harvested closer to the village and airport. Those wanting a fresh meal go nearby and “pull up” just enough. Dolly Varden are also harvested during ice fishing in an area from below Bessie Creek to the mouth of the Arolik River. The area below Bessie Creek is a favorite spot for ice fishers. Paul thought that a Kwethluk couple harvested Dolly Varden from the confluence of the Kanuktik and Kanektok rivers.

Goodnews Bay: During the lives of these elders, Dolly Varden were harvested from camps on the Goodnews River. When Bavilla became an adult, he harvested Dolly Varden at his summer camp, *Nekliyagak*, on the Goodnews River. In winter Dolly Varden were harvested from the village side of the bay, in channels.

Osviak: When Charlie was a child, his family moved up the Osviak River to *Pengitat* in fall and harvested Dolly Varden.

Dolly Varden Gear Type

Quinhagak: During his early life, Paul’s family harvested Dolly Varden with nets. There was very little other equipment. As an adult, Paul made fishhooks out of reindeer leg bones.

In modern times, Dolly Varden are harvested during ice fishing from the Kanektok and Arolik rivers.

Goodnews Bay: During Bavilla’s early life, Dolly Varden were harvested by jigging in the winter from the main Goodnews River. Net fishing for Dolly Varden occurred also along the Goodnews River.

In modern times, Dolly Varden are harvested primarily by jigging through ice.



Immature Dolly Varden, locally called anerrluaq or igallugpiit, are harvested in great numbers during the fall with various nets, and during the winter ice fishery. USFWS photo

Dolly Varden Harvest Levels

Quinhagak: Now and in the past, Dolly Varden are commonly harvested for a fresh meal. During Paul's adult life, when he had a motorboat, he remembers harvesting as much as "three boats" of Dolly Varden. One-hundred-pound flour bags were filled with fish for storage. Large quantities were harvested and dried for dog food.

Goodnews Bay: Bavilla said of his early life, that in winter, his family lived on fresh fish such as Dolly Varden and Bering cisco jigged from the main Goodnews River all winter. At certain times of year, Dolly Varden were also harvested for dog food.

Bavilla explained that fish were stored in empty 55-gallon barrels holding approximately 250 to 300 pounds each. Not knowing how cold the upcoming winter was going to be, fishermen harvested large quantities for dog food. When he had dogs, five barrels would not be enough to feed them through winter because working dogs eat a lot of fish, and there was no other possible way to get dog food. Today people do not harvest the large quantities they once did because teams of dogs are no longer needed and harvesting is for personal use only. During the 2003–2004 ice-fishing season, many more Dolly Varden were caught than is usual at the lower end of the river, but they were small in size.

Dolly Varden Season of Harvest

Now and in the past Dolly Varden are harvested year round, especially for immediate eating. In the past, when dog teams were maintained, larger quantities of Dolly Varden were harvested in spring and especially fall when they are concentrated and easier to catch. Jigging occurred throughout the winter.

Dolly Varden Preservation and Processing

In the past, large quantities of Dolly Varden were dried for dog food. Dolly Varden for human consumption were sometimes eaten fresh frozen. Dolly Varden were also split, dried, smoked, and cached in grass baskets for later use.

Dolly Varden Life History

In the fall they return from the ocean and migrate up rivers and streams. This is a good time to harvest many at one time in nets. As the fish get close to spawning the skin becomes a darker, murky gray color, and the flesh becomes light in color. The heads and tails appear longer and skinnier. When in this phase, they are sometimes called *iqalluigpik*. Immediately after spawning the fish disperse and are not seen in large numbers again all year.

Quinhagak: On the Kanektok River, Dolly Varden spawn in Oyak Creek; below *Tunir'carun*; *Caucikam*; *Taklig*; and in Klak Creek. Dolly Varden also migrate into the Arolik River.

Paul described the impact of beaver dams on Dolly Varden migration:

Before, when Dolly Varden came to the spawning grounds, they were like herring coming in, there were so many of them. Then beavers began damming the mouths of streams. When beaver block the mouth, fish can't use the area anymore. There're many spawning areas I know of that are blocked now and aren't used by fish anymore. This spawning ground above *Caucikam*, the *Taklig*, is blocked . . . There are no new spawning grounds. The fish don't go into new channels right away.



Pete Abraham cooks Dolly Varden (anerrluaq) freshly caught from the river. USFWS photo



Dolly Varden, like this spawned-out male, are locally called iqalluigpik. USFWS photo

A beaver dam also blocks the spawning area below *Tunir'carun*. Klak Creek was once dammed, but now Dolly Varden make it up this creek.

Goodnews River: Dolly Varden staging areas exist from the mouth of the Middle Fork Goodnews River up to the outlet of the lake, where the current is slack. Dolly Varden migrate up Barnum Creek. Charlie was told that a long time ago Dolly Varden never migrated past the "narrows" because of the swift current.

In 2004, the current had slowed and Dolly Varden were able to migrate to the outlet of the lake.

Dolly Varden migrate to Kuskokwim Bay around May and June, and return during the last part of July or the first part of August. In August Dolly Varden are migrating past a particular cut bank on the river, where people know them to be. In September they are far upstream in the river.

Dolly Varden Abundance

Quinhagak: Dolly Varden are not harvested in the quantities they once were and it was hard to estimate a trend in Dolly Varden abundance. One elder mentioned Dolly Varden were once more abundant in the river. One observation for this assessment was the increased harvest of Dolly Varden in fall 2003, but the beaver dams on tributaries of the Kanektok River are limiting Dolly Varden spawning.

Goodnews Bay: Bavilla pointed out that today Dolly Varden are not as abundant as they used to be ever since sport fishers, "those who fish for a day and go home," started coming to the area. It is his belief that catch-and-release fishing makes fish suffer and weakens them, making them easier for predators to catch.

Dolly Varden Distribution

Dolly Varden exist throughout the Quinhagak, Arolik, and Goodnews drainages.

Arctic Char (*Salvelinus alpinus*), *Yugyaq*

Arctic char are widely distributed throughout the major drainages in this study area, and spend most of their lives in or near the headwater lakes. There may also be remnant populations in land-locked lakes, and occasionally some fish do move into the main rivers throughout the year. There is limited specific knowledge about the life history of Arctic char in this study area, but they are thought to be all nonanadromous, resident species in this area (Lisac and Nelle 2000; Reynolds 2000). Based on the literature the Arctic char in this area likely mature at age six to nine and are thought to spawn every other year (ADF&G 2006; Morrow 1980). They spawn in the fall (August through October) along the lake shoals near tributaries of outlet streams. Hatching likely occurs in the spring, depending on water temperature and ice cover. Likewise, growth rates and maximum age vary depending on diet, water temperature, latitude, altitude, and genetics.

Description of Subsistence Patterns and Use Areas

Arctic Char Use Areas

Quinhagak: Arctic char are not usually harvested from the Kanektok drainage. An exception is Kagati Lake where, every once in a while, an Arctic char is harvested during fishing for Dolly Varden. They are also harvested occasionally with Dolly Varden and round whitefish at *Qas'gicuartalek* on the Kanektok River. Arctic char, Dolly Varden, and rainbow trout are harvested during ice fishing at the mouth of Bessie Creek on the Arolik River. Paul said that Arctic char are not harvested locally while jigging. They are jigged at the forks of Kanuktik and Kanektok rivers.



A pair of Arctic char, yugyaq, in spawning coloration. USFWS photo

Goodnews Bay: Bavilla had heard that Arctic char are in the Goodnews River, but he has only caught one, and Arctic char are not targeted. Charlie said Arctic char exist in the Goodnews River, and he has caught Arctic char from Goodnews Lake.

Arctic Char Gear Type

Quinhagak: Arctic char are harvested occasionally either during ice fishing or in nets targeting Dolly Varden and round whitefish

Arctic Char Season of Harvest

Quinhagak: Arctic char are harvested occasionally during ice fishing and in fall with nets when they are caught incidental to Dolly Varden and round whitefish.

Arctic Char Life History

Goodnews Bay: Arctic char stay in Goodnews Lake except in spring when they stage as far down as the confluence with the Middle Fork.

Arctic Char Distribution

Arctic char exist in the Kanektok, Arolik, and Goodnews drainages.

Lake Trout (*Salvelinus namaycush*), *Cikignaq*

Lake trout are the largest of the char species and can be distinguished from other chars by the absence of pink spots and by their deeply forked tails (Morrow 1980). Lake trout inhabit nearly all the large lakes that are connected to the main river systems within this study area. Land-locked populations have been recently documented in the Togiak valley to the east (Walsh et al. 2005), but none have been reported in the Kuskokwim Bay drainages to date. Lake trout spawn and rear in and around the lakes and are rarely found in the rivers. Only in the Goodnews River drainage have biologists and anglers reported lake trout being caught downstream of the lake and in the main river within 10 km of the Bay (Rob MacDonald, personal conversation). In spring, when the lake is cold, lake trout can be found near the surface, but they descend deeper as the lake warms in summer. Lake trout mature at age seven or eight. Spawning takes place at night over clean, rocky lake bottoms from September through November. Eggs hatch early in the following spring and juvenile lake trout are notoriously reclusive. Lake trout are considered long-lived, slow-growing species. Their growth varies across their range of distribution depending on diet, water temperature, altitude, and genetics. Alaska lake trout can live longer than 40 years (Morrow 1980). One specimen from Kagati Lake, near the headwaters of the Kanektok River, was determined to be 26 years old (Lisac and MacDonald 1995).

Description of Subsistence Patterns and Use Areas

Lake Trout Use Areas

Quinhagak: Lake trout are harvested occasionally from the headwaters of the Kanektok River.



Lake trout, cikignaq, caught in Kanektok drainage. USFWS photo

Goodnews Bay: Lake trout area harvested close to the outlet of Goodnews Lake and more rarely from the river.

Lake Trout Season of Harvest

Quinhagak: Lake trout are harvested during ice fishing.

Goodnews Bay: Lake trout are harvested in fall.

Lake Trout Life History

Goodnews Bay: Many trout and whitefish spawn in the river, including lake trout.

Lake Trout Distribution

Lake trout exist in the Kanektok and Goodnews drainages, but are observed primarily at the headwaters.

Rainbow Trout (*Oncorhynchus mykiss*), *Talaariq*

Rainbow trout inhabit the three major drainages in the study area and possibly a few of the smaller coastal drainages between the mouth of the Arolik River and Goodnews Bay. The northern limit of rainbow trout distribution in western Alaska is the southern tributaries of the Kuskokwim River upstream to Sleetmute (Mecklenburg et al. 2002; Morrow 1980). Only the stream-dwelling resident life history form of rainbow trout is thought to occur in this study area. Unlike the Bristol Bay drainages to the east, lake-dwelling populations of rainbow trout in this area are rare. There have been reports of rainbow trout caught in commercial fishing gear off the mouth of the Kanektok River (Willard Church, 2006, personal communication), but these are infrequent and are not considered evidence of anadromy (steelhead form) in Kuskokwim Bay rainbow trout.

Rainbow trout spawn in the spring from late April to June in shallow riffle areas of clear-water streams and rivers with ample currents and well-oxygenated water. Like salmon, rainbow trout are redd (nest) builders and bury the fertilized eggs in the gravel. The eggs mature in four to seven weeks, and the young begin emerging from the gravel during June through August. Most



A typical Kanektok River rainbow trout, talaariq. USFWS photo

fish in this area are slow growing and mature at age four or five after attaining a large enough size (approximately 500 mm or 20 inches). The migration pattern, behavior, and survival of southwest Alaska rainbow trout are highly dependent on the life cycle of Pacific salmon. Rainbow trout feed heavily on salmon eggs, fry, smolt, and the decaying flesh of spawned-out adults. Rainbow smelt (*O. mordax*) that migrate into freshwater during the spring, fall, and winter also factor heavily in the rainbow trout's diet.

Description of Subsistence Patterns and Use Areas

Rainbow Trout Use Areas

Rainbow trout are harvested from the Arolik River from the mouth to Bessie Creek. A favorite spot for ice fishers is below Bessie Creek. Rainbow trout are harvested incidentally and during ice fishing from the Kanektok and Goodnews rivers.

Rainbow Trout Gear Type

Quinhagak: Rainbows are harvested from the Arolik River during ice fishing. Henry observed this after moving to Quinhagak as a young adult.

During Elsie's early life her family harvested a fresh supply of "river trouts," rainbow trout, whitefish, and grayling in the fall, mostly with nets. This was an important fishing time. When food was scarce, they stayed close to the river. When her family was at fall camps on the Kanektok River, her father made hooks from bone and bigger hooks from nails, put red yarn on the end for bait, and went fishing. Using this method, her father caught rainbow trout.

In winter 2004, during ice fishing, a few rainbow and grayling were harvested while Dolly Varden were being targeted from the river right above the village.

Species Descriptions

Goodnews Bay: In Charlie's early life, Dolly Varden and rainbow trout were caught from the Goodnews River with nets described as smaller than salmon nets.

Rainbow Trout Harvest Levels

During the early life of elders to the present, rainbow trout were harvested in small numbers—except for Bessie creek where they were caught during ice fishing for char and grayling, and in nets put out for whitefish and Dolly Varden.

Rainbow Trout Season of Harvest

Quinhagak: During Elsie's early life, rainbow trout were harvested in fall.

Rainbow trout were harvested year round; especially during ice fishing in the Arolik River.

Goodnews Bay: Rainbows are harvested primarily in fall by jigging.

In the past, after chum and pink salmon were harvested in August and September from the Goodnews River, people pursued rainbow trout and other "river" fish. Rainbow trout were also harvested in nets in October.



Jigging through the ice is a popular fishing method to catch fresh meat throughout the winter. USFWS photo

Rainbow Trout Life History

Rainbow trout are present year round in the Goodnews Bay. Rainbow trout are harvested in fall, possibly when they gather before spawning.

Rainbow Trout Population Trend

Quinhagak: Earlier in Harry's adult life, rainbow trout were more abundant than they are now in the Arolik and Kanektok rivers. The cause may be sport fishers on the rivers.

Elsie said that in September 2004, while she was holding some roe in the water to attract trout, not one showed up except for a rainbow trout. The little fry she enjoyed so much when she was a child were not there.

Rainbow Trout Distribution

Rainbow trout exist in the Kanektok, Arolik, and Goodnews drainages, now and in the past.

Rainbow Trout Ecology

Quinhagak: Rainbow trout like to stay next to cut banks downriver from shallow areas in the river. They eat salmon roe.

Arctic Grayling (*Thymallus arcticus*), *Culugpauk*, *Nakrulluqpak*

Arctic grayling (grayling) occur in nearly all waters throughout the study area. Grayling primarily live in flowing waters, but also may spend time in area lakes, especially during the winter. Grayling life history is as varied as the habitat throughout the state they occupy (Morrow 1980). They can be sedentary and spend their whole lives in a small area, or undertake extensive migrations between spawning, feeding, and overwintering areas. No specific studies have been conducted on grayling in this region. The general life history for this species is as follows: Grayling move upstream from deep-water over-wintering areas to spawning locations in the early spring, usually shortly after breakup. They return to their home waters to spawn and select primarily sandy substrate areas. Unlike the other salmonids, grayling do not build a redd (nest), but instead form a depression during the act of spawning where the fertilized eggs fall and get covered with sand. Hatching occurs in 10 to 20 days and the young grow rapidly throughout the summer. Grayling usually mature at age four or five, when they grow to approximately 300 mm (12 inches). After spawning, adult grayling return to their usual summer feeding areas and establish territories based on an elaborate ritual to establish a pecking order. Grayling primarily feed on insects, small fish, and salmon eggs that are caught as they drift downstream. Establishing territories is beneficial to this feeding behavior. During the fall, grayling move downstream or into lakes to find deep water, where they will spend the winter.



Arctic grayling, nakrulluqpak or culugpauk, inhabit nearly all the river drainages throughout the study area. USFWS photo

Description of Subsistence Patterns and Use Areas

Grayling Use Areas

Quinhagak: Since her childhood, Elsie has harvested grayling from the Kanektok drainage. An occasional grayling is jigged from the river near Quinhagak.

Goodnews Bay: Grayling are harvested from the entire Goodnews River and Goodnews Lake.

Grayling Gear Type

Grayling and other species are caught during jigging through the ice near both Quinhagak and Goodnews Bay villages. Upriver, grayling are occasionally harvested in seines incidental to other targeted species, especially in spring when grayling school and spawn.

Grayling Harvest Levels

Small numbers of grayling have always been harvested with nets from the Goodnews and Kanektok rivers incidental to the harvesting of Dolly Varden and spawned-out salmon. They are occasionally targeted during ice fishing, but more commonly are harvested in a mix with other species such as trout, char, and whitefish.

Grayling Season of Harvest

Quinhagak: During Elsie's early and middle life stages, grayling, whitefish, and "trouts" were harvested with nets from the Kanektok River in fall. Paul added, "At the beginning of fall, from way back, we would go upriver to put up dry fish, coho, and spawnout reds, and we'd get Dolly Varden, grayling, and whitefish at the same time."

From the early lives of elders to the present, grayling have been harvested opportunistically in winter during ice fishing in the Kanektok drainage. Elders from Quinhagak reported that grayling were harvested in spring and winter from the Kanektok River.

Goodnews Bay: In spring grayling are harvested from the Goodnews drainage.

Grayling Preservation and Processing

Quinhagak: During the childhood of elders, grayling were eaten raw, both fresh and frozen. Henry said, “As soon as we pick them out of the net we can scrape the scales off with a knife and eat them raw right away.” And further, “We also can eat Dolly Varden (raw), but we have to freeze them first.” These species are now harvested closer to the village. “Back then we used to travel upriver for them. Now they are fished near the airport and village. People who want a fresh fish meal go out and pull up just enough for a meal,” explained Henry.

During Paul’s early life, his mother processed grayling by gutting, cleaning, and storing them in a hole in the ground. This is called *kasiak*, aged fish.

Grayling Life History

Quinhagak: In the Kanektok River grayling school in spring before spawning.

Goodnews Bay: Grayling spawn in Barnum Creek. Grayling stage as far down as the confluence of the main river with the Middle Fork. One elder observed that grayling eggs enlarge in fall, and grayling may spawn sometime in fall or winter.

Grayling Population Trend

Quinhagak: There are concentrations of grayling in the Kanektok River and Bessie Creek on the Arolik River. The distribution of grayling appeared to be expanding, “There are more on the tributaries of the Kanektok River and they seem to enjoy it.”

Goodnews Bay: Grayling have never existed in large numbers in the Goodnews River.

Grayling Distribution

Quinhagak: Grayling are abundant in places in the Kanektok drainage and in Bessie Creek, a tributary of the Arolik River. Grayling populations are currently moving into more Kanektok tributaries, specifically *Qas’gicuartalek*, a seasonal camp used by Henry’s family, located below the bluffs, and *Pwoiulnguar* below *Sayaalituuli*.

During his early life, Henry was told that the headwaters of Warehouse Creek were called “grayling country.”

Goodnews Bay: Grayling are present in the Goodnews drainage in all seasons. Specific locations that were mentioned include Barnum Creek and Goodnews Lake.

Grayling Ecological Relationships

In interviews, grayling and whitefish were often discussed together, suggesting an association in the distribution and harvest of these two types of fish.

Round Whitefish (*Prosopium cylindraceum*), *Cauirrutnaq*

Round whitefish are distributed throughout the entire mainland of Alaska (Morrow 1980). Round whitefish are reported to be abundant in the lakes and rivers within the study area, but no directed studies have occurred on this species to substantiate these observations. They spawn in the fall, usually during October to December. They mature at age five to seven, and individual fish spawn every year. During the fall they migrate to gravel river shallows or in-shore lake shallows. They do not build redds, but instead members of a pair will lie next to each other on the bottom and expel eggs and milt at the same time. The fertilized eggs are left to drift and fall into crevices between rocks and debris. The eggs hatch in approximately 140 days and growth rates vary with locality and latitude. Round whitefish can obtain a maximum age of 16 years and reach a maximum size of 560 mm (22 inches).

Description of Subsistence Patterns and Use Areas

Round Whitefish Use Areas

Quinhagak: During Elsie’s childhood, round whitefish were sometimes harvested during ice fishing in the Kanektok River. In Henry’s adult life stage, round whitefish were harvested at *Qas’gicuartalek* on the Kanektok River.

Round whitefish are harvested from the Kanektok and Arolik rivers.

Goodnews Bay: Round whitefish are harvested from almost anywhere in the Goodnews River and Lake.

Round Whitefish Gear Type

Quinhagak: During Elsie’s childhood, round whitefish were sometimes harvested during ice fishing in the Kanektok River.



Round whitefish, cauirrutnaq. USFWS photo

Goodnews Bay: In Charlie's adult life, round whitefish were caught in summer and fall with small nets.

Round Whitefish Harvest Levels

Quinhagak: Round whitefish are not caught in large numbers from the Kanektok River until fall. During the early and middle life stages of elders, more round whitefish were harvested than now.

Round Whitefish Season of Harvest

Quinhagak: Round whitefish are harvested in late summer and fall from the Kanektok River, now and in the past. A few are jigged in winter.

Goodnews Bay: Round whitefish are harvested from the Goodnews River in late summer and fall, now and in the past.

Round Whitefish Preservation and Processing

Quinhagak: In the early life stages of elders, whitefish were harvested specifically to be eaten raw and raw frozen. Even today, Henry said, "When one is pulled up everyone gathers around for a fresh raw meal!" Some still go upriver to harvest round whitefish to eat frozen, but not very many "because our diet has become westernized," explained Henry. In the childhood of elders, meals often had a component of some sort of uncooked fish or even caribou.

Round Whitefish Life History

Goodnews Bay: Round whitefish are resident in the Goodnews River and Lake. There are round whitefish in the lake year round. They stage in the upper Goodnews River down to the Middle Fork.

Round Whitefish Distribution

Round whitefish exist in the Kanektok, Arolik, and Goodnews drainages.

Least Cisco (*Coregonus sardinella*), *Kassiaq*

The least cisco is likely present in the lakes and rivers throughout most of the study area (Morrow 1980). Stream-dwelling, lake-dwelling, and anadromous populations occur throughout the region and possibly within the same drainages. Stream-dwelling and anadromous populations can undertake considerable migrations between wintering and spawning areas. Spawning occurs in the fall, during September and October. Spawning occurs at night over areas of mixed gravel and sand. A female fish swims vertically from the bottom towards the surface and is accompanied by as many as five males. They release eggs and milt simultaneously as they near the surface and swim back to the bottom. The fertilized eggs settle within the gravel at the bottom and spend the winter. They hatch early in the spring and by June large numbers of juvenile fish are migrating downstream to slower and deeper water. These fish grow fairly

rapidly and mature at age two to four. They reach a maximum size of approximately 400 mm (16 inches).

Description of Subsistence Patterns and Use Areas

Quinhagak: Henry did not recognize least cisco, nor the names used by the interviewer, *qas-sayaaq* and *neqyaaq*. Elsie did recognize least cisco and called the fish, “The one with a pointed snout.” She said they are a “fish of the bay,” and were different from Bering cisco, *imarpinraat*. Elsie called them *cingikeqliq*. There were no other comments made about least cisco specifically.

Bering Cisco (*Coregonus laurettae*), *Imarpinraq*, *Naptaq*

Bering cisco occur in the nearshore coastal waters and in most river systems throughout this study area. Very little specific knowledge exists on the biology and life history of Bering cisco. These fish are documented to be anadromous and overwinter in either salt, estuarine, or fresh waters. Spawning runs can begin as early as in the spring, although spawning does not occur until the fall. It is likely that the Bering cisco in this study area do not undertake the extensive spawning migrations that are described for populations in some of Alaska’s larger rivers. After spawning they are thought to descend the rivers to the area where they intend to spend the winter. Bering cisco grow to a maximum size of 250 to 330 mm (10–13 inches) throughout their range.

Description of Subsistence Patterns and Use Areas

Bering Cisco Use Areas

Apokak: Bering cisco were harvested from Apokak Slough when Henry was a child.

Quinhagak: Henry said that people once traveled upriver to harvest Bering cisco, among other species. However, now many people harvest them near the airport and the village.

Goodnews Bay: During Bavilla’s childhood, Bering cisco were harvested from the Goodnews River at *Yugciit*.



USFWS photo

Bering Cisco Gear Type

Apokak: When Henry was a child, Bering cisco and other fish were harvested with spears.

Quinhagak: In April, people used small hooks to harvest Bering cisco from the Kanektok River below the village tank farm. Bering cisco are caught locally by peering into holes drilled in the ice and snagging them, a method of jigging. Bering cisco are almost always snagged.

Goodnews Bay: From the childhood of elders to the present, people have jigged for Bering cisco in winter at *Yugcut*, and ice-fished at other places on the river.

Bering cisco are also harvested in fall and winter with nets. Sometimes nets are set under the river ice.

Bering Cisco Season of Harvest

Quinhagak: Bering cisco are harvested in winter through April from the Kanektok River. April was mentioned specifically as an advantageous time to harvest them locally.

Goodnews Bay: Bavilla, from memories of his early life, said that the most fishing for Bering cisco occurred whenever people ran out of other things to harvest. During parts of winter, Bering cisco, Dolly Varden, and an occasional smelt were relied on for fresh food and jigged through the ice on the Goodnews River.

Bering Cisco Preservation and Processing

Bering cisco, now and in the past, are eaten fresh.

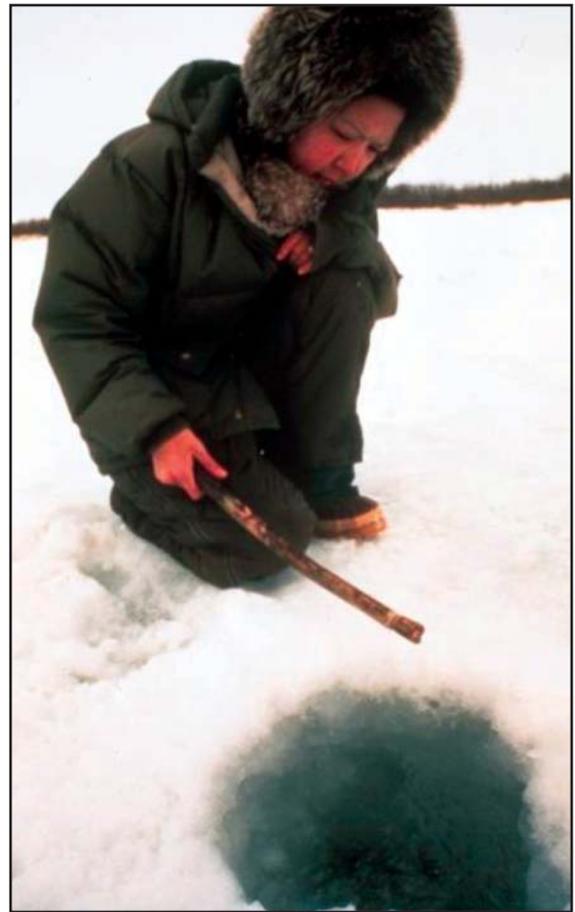
Bering Cisco Abundance

Quinhagak: Bering cisco are considered abundant in the Kanektok River.

Goodnews River: Bering cisco are becoming abundant, but were rarely seen in earlier times in the Goodnews River.

Bering Cisco Distribution

From the early lives of elders, Bering cisco have existed in Apokak Slough, and in the Kanektok and Goodnews rivers.



Jigging for fish through the ice. USFWS photo

Rainbow Smelt (*Osmerus mordax*), Iqalluaq

Rainbow smelt occur in the coastal waters and river systems throughout this study area. Most of the knowledge on the biology and life history of this species comes from studies on Great Lakes and Atlantic coast populations. Rainbow smelt are anadromous, spending much of their lives in the nearshore salt water and tidal portions of the rivers. They appear to move inshore during the fall and move in and out of the river systems with the tide. In the spring, even before ice-out, smelt will congregate near the mouths of the spawning streams. Homing tendencies seem to vary and it is uncertain whether there are individual spawning populations. Spawning tends to occur in the lower rivers not more than a few kilometers upstream of tidal influence in areas of sandy gravel and rocks. The fish crowd together and move upstream. When a male and female come in contact, they expel eggs and milt simultaneously. This activity may extend over several weeks to even months as the fish tend to reach sexual maturity over a prolonged period. Larger fish usually spawn first, and smaller fish will spawn later in the run. The eggs settle quickly to the bottom and hatching generally occurs within 20 to 30 days. The young are weak swimmers and are carried downstream to the estuary area. Growth rates vary by population, but most fish grow to 240 mm (9 inches) by their sixth year. Rainbow smelt mature at age two or three and may spawn several times in their lives—although the majority of smelt in an annual spawning run are first-time spawning fish (age two).

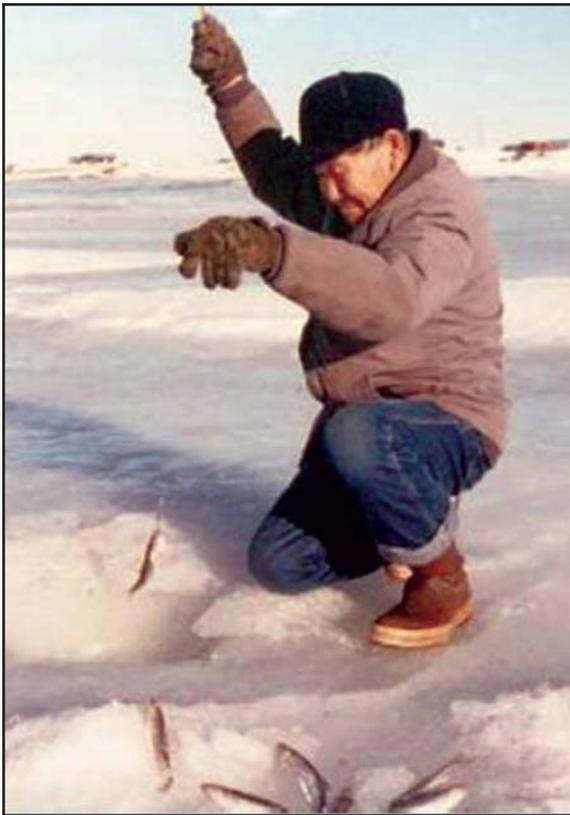


Rainbow smelt. USFWS photo

Description of Subsistence Patterns and Use Areas

Rainbow Smelt Use Areas

Apokak: Smelt were harvested from the Apokak Slough near the village of Apokak in Henry's youth.



Sam Carter jigging rainbow smelt, iqalluaq, through the ice in the Kanektok River downstream of Quinhagak. USFWS photo

Quinhagak: Smelt are harvested from the area below the Quinhagak village fuel tanks.

Goodnews Bay: Smelt are harvested from Goodnews bay and lagoon. Bavilla remembered from early life smelt harvested from the channels in the bay.

Smelt Gear Type

Apokak: In Henry's early life, smelt were harvested with spears.

Quinhagak: Since the childhood of elders, early arriving smelt have been dipnetted at the Kanektok River mouth, and ice-fished from the Kanektok River.

Rainbow Smelt Harvest Levels

Smelt were an important resource, arriving early in the spring, and preserved in large quantities during the early lives of elders.

Rainbow Smelt Season of Harvest

Quinhagak: In the early lives of elders, smelt were harvested from the end of May until the end of June.

Goodnews Bay: Fishing for smelt occurs throughout winter into spring from Goodnews Bay.

Rainbow Smelt Preservation and Processing

Quinhagak: From Elsie's early life stage, she remembered collecting lake grass from the beach. Her aunt saved the grass and it was later used to braid smelt. First thing in the morning, braided smelts were turned to prevent them from sticking together as they dried. Smelt were stored on top of the house, fish rack, and smokehouse until some were needed. Some smelt were gutted and fermented.

Henry remembered from his adult life that smelt were braided and dried by women. Smelt were dipnetted late into the night sometimes, and women attended to them the next day. The braided smelt were hung on fish racks to dry. Some people dried so much smelt that their fish racks were almost completely full and were attended to constantly. Later, the braids of smelt were placed in smokehouses and smoked. Smoked smelt was desired by many and was often eaten with seal oil.

Rainbow Smelt Life History

Smelt arrive in the Kanektok River immediately after Chinook salmon, then spawn, and at least some stay all winter, caught by ice fishers.

Rainbow Smelt Population Abundance

Quinhagak: Smelt are plentiful in the Kanektok River.

Goodnews Bay: Smelt are always plentiful in Goodnews Bay and River.



Rainbow smelt, iqalluaq, are available from late fall through spring. They are harvested primarily through the ice and hung to dry during the winter subsistence fishery. USFWS photo

Rainbow Smelt Distribution

Smelt were observed in Apokak Slough during Henry's early life and are in the Kanektok and Goodnews drainages.

Capelin (*Mallotus villosus*), Cikaar***Description of Subsistence Patterns and Use Areas****Capelin Use Areas*

Quinhagak: Several elders said capelin were scarce in the area, if present at all. Henry did not recall seeing capelin at Apokak or *Ciniq*.

Goodnews Bay: Capelin are harvested at the inlet of Goodnews Bay in spring.

Osviak: During Charlie's early life, capelin were harvested from the mouth of the Osviak River in spring.

Capelin Season of Harvest

In both Goodnews Bay and Osviak, capelin are harvested in spring.

Capelin Preservation and Processing

Osviak: Capelin were braided with grass and hung to dry during Charlie's childhood.

Capelin Life History

Capelin are present in spring in Goodnews Bay. Capelin arrived at Osviak in spring before Chinook salmon.

Capelin Distribution

Capelin are scarce at Quinhagak. They exist in Goodnews Bay and at Osviak during spring.

Pacific Cod (*Gadus macrocephalus*), Manignaalleryak

There are three cod species that inhabit the nearshore waters in this study area and may be available for subsistence harvest: Pacific cod *Gadus macrocephalus*, saffron cod *Eleginus gracilis*, and Pacific tomcod *Microgadus proximus*. The life histories are similar, but vary in specific spawning and summer locations. The Pacific cod is presented here as an example of cod life history. Pacific cod occur throughout the study area, north to Norton Sound and along the entire southern Alaska coast. They occupy primarily marine waters, but are known to move inshore after spawning occurs, which is usually during the winter months. By late summer they move back to the spawning areas of deep marine waters. The eggs are demersal (they sink) and adhesive during the first 30 hours. The eggs hatch in 8 to 29 days. This fish is unique in that it grows just as fast in winter as it does in summer. Sexual maturity is reached at age two or three. The highest recorded age is 13, but maximum age is normally 7.



Pacific tomcod. USFWS photo

Description of Subsistence Patterns and Use Areas

Since Charlie's childhood, Pacific cod have been caught with hooks at the mouth of Osviak River in spring. They arrived with capelin.

Pacific Tomcod (*Microgadus proximus*), *Ceturrnaq*

Description of Subsistence Patterns and Use Areas

Tomcod Use Areas

Quinhagak: During Henry's adult life stage, tomcod were harvested at *Ciniq* by people traveling from Quinhagak. Tomcod are also harvested during ice fishing near the mouth of the Kanektok River, after a large high tide.

Goodnews Bay: Tomcod are harvested below *Avisrayaq* (Beluga Hill) in a small bay, specifically at the north creek by some small ponds, starting in December.

Tomcod Harvest Levels

Quinhagak: During his adult life stage, Henry said enough tomcod were harvested from *Ciniq* to fill at least several grass-woven containers.

Tomcod are not abundant in the Quinhagak area but are harvested in the winter ice fishery near the mouth of the Kanektok River. Elise explained, "They hardly get [tomcod] but once in a while."

Goodnews Bay: There is a targeted tomcod fishery in Goodnews Bay, but it is not clear how many are harvested.

Tomcod Season of Harvest

Quinhagak: During Henry's adult life stage, tomcod were harvested at *Ciniq* right after the first freeze in fall.

Tomcod are harvested during ice fishing at the mouth of the Kanektok River.

Goodnews Bay: Tomcod are harvested in winter from Goodnews Bay near Beluga Hill. After the first of December is a particularly good time to harvest them.

Tomcod Life History

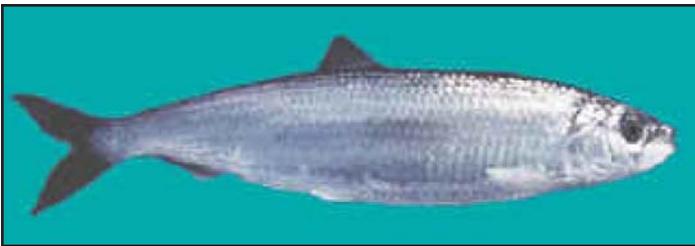
Goodnews Bay: Tomcod stage in Goodnews Bay near Beluga Hill.

Tomcod Abundance

Quinhagak: Tomcod are not abundant in the Quinhagak area, now or in the past. There was a larger abundance at *Ciniq*, where tomcod were targeted during ice fishing.

Tomcod Distribution

Tomcod existed at *Ciniq* during the earlier adult life of Henry. Tomcod are observed at the mouth of the Kanektok River, and in Goodnews Bay. Elsie mentioned tomcod are in the Kanektok River.



Pacific Herring. ADF&G photo

Pacific Herring (*Clupea harengus*), *Iqalluarpak*

Pacific herring are an ocean migratory species that are found along the entire Alaska coast. They spawn during the spring, usually in May. Spawning occurs in shallow, vegetated areas in the intertidal and subtidal zones. Most spawning in

this study area occurs in Security Cove, Chagvan Bay, and Goodnews Bay. Other small bays are probably used as well, but no significant concentrations occur along the coast from Goodnews Bay north to the Kanektok River. Herring reach sexual maturity at age three or four, and spawn every year thereafter. Herring broadcast their sticky eggs over vegetation. The males disperse clouds of milt to fertilize the eggs. The eggs hatch in approximately two weeks, depending on water temperatures. The larvae and young herring drift with the ocean currents and suffer high mortality as they are preyed upon by an extensive array of predators. As they grow, they seek sheltered bays and inlets until they mature. Other than at times of spawning and young rearing in nearshore waters, herring spend the rest of the year offshore feeding on zooplankton. The average life span is about eight or nine years, but has been documented as high as 16 years in the Bering Sea. Herring are harvested commercially and also for subsistence. Herring are consumed whole and as mature roe-on-kelp (or eel grass) by the people of southwest Alaska.

Description of Subsistence Patterns and Use Areas

Herring Use Areas

In Goodnews Bay, subsistence setnets to harvest herring are put inside the spit as far as Beluga Hill. Commercial nets are also used in this area.



Schools of Pacific herring (dark spot in middle of photo) move inshore to spawn in the spring. During this time they are accessible for subsistence harvest. USFWS photo

Herring Gear Type

Herring are harvested with setnets in Goodnews Bay.

Herring Harvest Levels

Outside the commercial fishery, nets are rarely set for herring any longer. Herring nets used today harvest large quantities of herring, more than can be processed by one family, and herring for home use is probably removed from commercial catches. Informants from Quinhagak report that a small number of herring are harvested for home use by their community.

Herring Season of Harvest

When Bavilla was a child, herring were harvested in spring, around May, when they migrated to Goodnews Bay.

Herring Preservation and Processing

Herring harvested from Goodnews Bay are scraped of scales, dried, and smoked.

Pacific Salmon (*Oncorhynchus species*)

Five species of Pacific salmon are abundant throughout the study area. The sixth species, rainbow trout, were treated separately in this discussion. The five species have adapted to take advantage of nearly all habitat types in this region. Their life histories follow a similar pattern, but differ in the amount of time spent at the various life stages. All are anadromous—spending time in the ocean and returning to freshwater to spawn. Pacific salmon primarily return to their natal waters to spawn, but straying and colonization of new habitats is well documented (Quinn 2005). One to several males may spawn with a single female. The female usually digs a redd, or nest, using her tail and continues this action upstream to bury the previously fertilized eggs with gravel. The eggs and young develop in freshwater and first enter the ocean water immediately as fry (pink and chum salmon) or emigrate as “smolt” after one or two years of freshwater growth (coho, Chinook, and sockeye salmon). Out at sea the young salmon grow quickly and mature in one to seven years, when they return to freshwater to spawn. All Pacific salmon are semelparous, that is they die after reproducing. This strategy has probably evolved for several reasons; the most obvious is the fertilization of the local ecosystems, which ensures their progeny’s survival. When the adult salmon return from the ocean they transport millions of kilograms of nutrients to the upper reaches of the freshwater drainages. These nutrients are fed into the food chain in the form of eggs and decaying salmon flesh.



A female Chinook salmon, tarryaqvak, migrates upstream in the Middle Fork Goodnews River. USFWS photo

Chinook Salmon (*Oncorhynchus tshawytscha*), *Taryaqvak*

Chinook salmon are abundant in the Kanektok, Goodnews and Arolik river drainages. Smaller populations, probably less than 100 fish, likely occur in the smaller drainages to Kuskokwim Bay. Chinook return to the rivers from May to August and spawn during late July and August. They primarily spawn in the main river channels or larger tributary waters, and excavate redds in large gravel and rock. The eggs usually hatch in late winter or early spring. Most juvenile Chinook salmon rear in the river environment until the following spring. They then migrate to the ocean as smolt in their second year. They will spend one to seven years at sea before they mature and return to freshwater to spawn. Females tend to mature later and at a larger size than males (spending four winters at sea and maturing in the 6th year). Small Chinook that mature after spending only one winter at sea are usually males and are referred to as “jacks”. The average weight of Chinook salmon in the Kuskokwim area commercial harvest is 15.4 pounds.

Description of Subsistence Patterns and Use Areas

Chinook Salmon Use Areas

Quinhagak: During the adult lives of elders, Chinook salmon were harvested in nets set with the help of rowboats a short distance up the Kanektok River, and below its mouth. In modern times, Chinook nets are likely to be set on the north side of the Kanektok River, near the mouth.

Goodnews Bay: When he was a child, Bavilla’s family harvested Chinook salmon from its spring camp at the mouth of *Uqvigar* Creek, on Goodnews Bay. Later, when Bavilla became an adult, he harvested Chinook salmon from Goodnews Bay and at his summer camp, *Ekliyagak*, on the Goodnews River while also harvesting sockeye and chum salmon. At that time Chinook were harvested in nets from a stretch of river from the mouth of the Middle Fork Goodnews River up to *Yugcut*.

In later times, Chinook were harvested closer to the village, and from the mouths of the three forks of the Goodnews River.

Osviak: During Charlie’s early life, Chinook salmon were harvested at *Asgyukpak* Creek, the middle creek across from the spit in front of Osviak village. This place is called *Aqlanquq*.

Chinook Salmon Gear Type

Quinhagak: Chinook nets are used to harvest Chinook salmon, unlike during the early and middle life stages of elders, when the same size nets were used to harvest all species of salmon.

From his early life, Kenneth remembered hearing that nets to harvest Chinook salmon were set at the mouth of rivers. Nets were made and mended by hand. They were about 2 feet by 4 feet, and set from kayaks. In later times, Chinook salmon were fished only on the incoming tide. Coming back in with a net full of fish took time and the task was started as soon as possible when salmon were in the net.

In the past, Chinook salmon were harvested in nets set on river beaches near the mouth of the Kanektok River. Not having the strong currents of Bristol Bay, it was not necessary to drift the net. In modern times, Chinook salmon are harvested quickly because of better nets.

Goodnews Bay: During his early life, Charlie said that nets of the same mesh were used to harvest all salmon at Osviak and Goodnews Bay. Specialized Chinook salmon nets, *tary-aqvagcutenek*, were introduced later.

Drift nets are employed in an area from the channel in the bay to the mouth of the river. Setnets, and sometimes herring nets, are used to harvest Chinook salmon during the later part of May.

Chinook Salmon Harvest Levels

Goodnews Bay: In the early lives of elders, Chinook salmon were not as easily harvested as in modern times with specialized nets and motorized boats. This may lead to more Chinook salmon being harvested today; however, most elders said it was easier to harvest in recent times, not that they harvested more.

One elder reported harvesting 15 to 25 Chinook salmon a season.

Chinook Salmon Season of Harvest

Quinhagak: A few Chinook arrived in late May, followed by a large pulse in June. In the past, Chinook were harvested in June after squirrel trappers and muskrat hunters returned from spring camps. Gradually, up to 2004, fewer moved to spring camps for these purposes and Chinook fishing began earlier, in May.

Paul said he started fishing for Chinook in mid-March even though he wouldn't catch any.

Goodnews Bay: In Bavilla's early life, Chinook were harvested right before herring disappeared from the bay. Later, he started Chinook harvesting in June, probably after arriving from spring camp.

Osviak: At Osviak, Chinook harvesting began immediately after the Arctic terns laid their eggs and the first salmon arrived.

Chinook Salmon Preservation and Processing

Apokak: At Apokak, when Kenneth was young, women were using metal knives to process Chinook. The backbones and heads were hung to dry separately. When dry, the fish were smoked.

Quinhagak: Kenneth said that for the past five years he has not harvested salmon, but his children harvest Chinook and sockeye salmon and share them. After his children harvest the salmon and the drying process is complete, he and his wife take over the smoking process, making sure it is done correctly, and the salmon are stored properly.

Before freezers, salmon were stored in caches off the ground about 4 feet. When Chinook and other fish are stored close to the ground they develop mold and are not appetizing. If salmon



Chinook salmon, tarryaqvak, are sometimes cut into strips, salted, and smoked after being dried for days in open air. USFWS photo



The finished product. Great care is put into the time-consuming process of preparing these Goodnews River "king" strips. USFWS photo

are left too long in the smokehouse they develop mold. When salmon are cached in fresh air, mold is less likely to develop or develops only slightly.

Goodnews Bay: Chinook are smoked or salted and smoked.

Chinook Salmon Life History

Quinhagak: Chinook dribble into the river a few at a time beginning in May. They spawn in shallow water behind sandbars on the main river, digging into the gravelly river bottom.

Goodnews Bay: Chinook arrive in Goodnews Bay when a few herring can still be seen in the latter part of May. Chinook are abundant in the bay by mid-June.

Chinook moving past Cape Newenham go directly up Kuskokwim Bay first, because the current in that direction is strong, before arriving in Goodnews Bay. This is why Chinook often arrive at Quinhagak a week before Goodnews Bay. Chinook also arrive early at Security Cove.

Chinook Salmon Abundance

In the memories of elders, Chinook abundance has not changed, but has varied from year to year. Several elders explained that the Chinook nets used today are much more efficient than when they were young. Add to this the common use of skiffs and motors, and adequate numbers of Chinook can be harvested in a much shorter time than in the past. It can sometimes seem that Chinook are more abundant than in the past.

Chinook Salmon Distribution

Chinook migrate to the Osviak, Goodnews, and Kanektok rivers as well as to Security Cove.

Chinook Salmon Natural Indicators

Quinhagak: Elders were taught that when Chinook arrived with small salmon, or jacks, there was going to be an abundance of Chinook.

Goodnews Bay: Some years there are fewer salmon and other years more. One natural indication of salmon return is the wind. When the prevailing winds are consistently coming from the south, the return is good on the Nushagak River. If the prevailing wind is westerly, the Naknek River is having a good return of salmon. And if the prevailing wind is southeasterly, the Kuskokwim River will have a good return. Sometimes the wind is from the northwest, bringing the fish into Goodnews Bay.

Sockeye Salmon (*Oncorhynchus nerka*), Sayak

Sockeye salmon are abundant in the Kanektok, Goodnews, and Arolik river drainages, respectively. Smaller populations, probably less than several hundred to a thousand fish, likely occur in the smaller drainages to Kuskokwim Bay. Sockeye return to the rivers from late June to August and spawn from mid-August to September. They primarily spawn along shoreline shoal areas of all lakes and connected ponds in a drainage. There is also a considerable component of sockeye salmon spawning in side channels and sloughs along the main river course. The eggs usually hatch in winter and the young fry emerge in the spring. Most juvenile sockeye salmon



Sockeye salmon, sayak. USFWS photo

rear in lakes and slow-current channels for one year before migrating to sea in the spring and summer. They spend two or three years at sea before they mature and return to freshwater to spawn in their third or fourth year of life. The average weight of sockeye salmon in the Kuskokwim area commercial harvest is 7.0 pounds.

Description of Subsistence Patterns and Use Areas

Sockeye Salmon Use Areas

Quinhagak: During Paul's early life, spawned-out sockeye and some coho were harvested in the fall in the headwaters of the Kanektok River.

Goodnews Bay: During Bavilla's early life, sockeye were harvested from Goodnews Bay, specifically at the mouth of *Uquigar* Creek, where his family sometimes stayed in a sod house. During Bavilla's middle life stage he harvested sockeye at *Ekliiyagak*, on the Goodnews River.

A seldom-used tent campsite at the point across the river from Goodnews Bay village was pointed out to Charlie when he moved to Goodnews Bay village as an adult. It was once a summer camp where villagers harvested salmon. When sockeye began hitting nets, Charlie usually set his net near the mouth of the Middle Fork Goodnews River. All three mouths of the Goodnews River are sockeye-harvesting sites.

Osviak: There are few sockeye salmon in the Osviak River because it does not flow from a lake in which sockeye can spawn.

Sockeye Salmon Gear Type

Sockeye were caught with setnets. In Bavilla's early life he saw sockeye harvested with spears at a spawning area on the Middle Fork Goodnews River.

Sockeye Salmon Harvest Levels

Bavilla at Goodnews Bay estimated he preserves about 50 to 100 sockeye a year for himself and some of his children. In addition, he harvests 10 to 20 spawned-out sockeye salmon.

Sockeye Salmon Season of Harvest

Sockeye are harvested in June, and again in August and September.

Sockeye Salmon Preservation and Processing

Quinhagak: Sockeye are often dried before being cured or smoked.

In 2004 elders mentioned that they were instructing their children to process Chinook and sockeye salmon “with care and the right way.” After salmon are dried and put in the smoke-house, some elders take over the smoking process, making sure that salmon are smoked just right. Sockeye are then stored for the winter.

During Elsie’s early life, every part of the fish was hung, including the esophagus and spawn (white milt, *errit*). When dog teams were commonly in use, even the gills of the fish were dried and stored for dog food.

Goodnews Bay: Sockeye salmon are dried and salted. In 2004 a few spawned-out sockeye were dried still.

Sockeye spoil quickly after being caught because sockeye spawn and die earlier in the summer than other species of salmon in the Goodnews Bay.



Spawned-out sockeye salmon, sayak, are harvested for subsistence for their unique meat quality. Especially prized are the “humps” from males like this one. USFWS photo



Sockeye salmon, sayak, split and cut into blankets for drying and later smoking. USFWS photo

Sockeye Salmon Life History

Quinhagak: Both sockeye and chum enter the Kanektok River with Chinook salmon. Sockeye begin turning red in early September. *Sayalituuli* is the name of both a tributary and an abandoned settlement named after sockeye salmon. During the adult life stages of elders, this area was red with spawning sockeye, but by 2004, elders did not know if this was still the case.

Sockeye spawning areas are called *qecikllut'*, warm spots that do not freeze, and *kangiicullernek*, little tributary lakes. Sockeye migrate into the mountain and canyon creeks and streams, though not as many as in the past. Reportedly, sport fishers in boats have blocked the entrances to spawning grounds and prevented salmon from moving into them.

From early memories, elders knew of a sockeye spawning area on the Kisaralik River at Canyon Creek. Sockeye also spawn in the tributaries to Kagati Lake, at the headwaters of the Kanektok River.

Goodnews Bay: First, Chinook and chums arrived in the Goodnews River, and later sockeye. Sockeye begin spawning in August and continue into fall. Sockeye are longer lived at the lower end of the river where they lie protected behind sandbars in the river. The size of the sockeye return varies from year to year.

The main river and Middle Fork both have many tributaries originating from lakes in which sockeye like to spawn. The South Fork has no lake. The flow of the Middle Fork has been heavily impacted by beavers' blocking the river with dams, and some channels have dried up over the years and new channels carved by the flooding river. Sockeye no longer spawn in blocked or dried-up areas of the river. Reportedly, however, sockeye change spawning areas.

Moving up the main river, spawning areas include: *Qauturiarat* (Barn Swallow Bluff) at the first cut bank on the main river and just below the bluff; *Tulukaruiagat* (Little Raven's Bluff) at the cut bank above Barn Swallow Bluff; above *Kiqertarmmuit* (Island Camp) below the cut bank and bluff; Barnum Creek (a small spawning area); across from and above Isurik Creek; below *Awayaq* (Branch Creek); *Neqaicuqnaq* Creek; and *Orasqaq* Creek in a small pond, located immediately above *Neqaicuqnaq* Creek. Sockeye spawn in Goodnews Lake and lagoon. Many sockeye enter Goodnews Lake and have been observed at the head of the lake where one elder was told sockeye migrate still further into a small creek.

The Middle Fork Goodnews River does not have great numbers of sockeye, although spawning sockeye are observed in almost every tributary and area of slack water. Spawning areas on the Middle Fork are located at Lookout Mountain, *Kangiisulleq*, and sloughs along Barnum Creek become full with spawning sockeye. Sockeyes do not spawn in *Nimgun* Creek, probably due to the swift current. Beyond *Nimgun* Creek another tributary flows from several small ponds where sockeye spawn. The two ponds fill with fish earlier than other areas. Stories tell of these ponds holding sockeye as early as April or May.

On the South Fork Goodnews River sockeye spawn at *Gangqairaq* (Backwater).



The lake shoals are dotted with spawning sockeye salmon redds. USFWS photo

Sockeye Salmon Abundance

Quinhagak: It was reported that fewer spawned-out sockeye have been observed in the Kanektok River since the number of sport fishers increased dramatically in the 1980s. It was observed that sport fishers raft down the river in great numbers, at times. Local residents described this activity as *nuyuq'lluki*, chasing the sockeye and decreasing the abundance by deterring them from entering spawning areas.



Sockeye spawn “in particular types of spots, qecikllut’, warm spots that do not freeze, and kangiicullernek, little tributary lakes . . .” USFWS photo

Sockeye do not spawn “any old place” but in particular types of spots, *qecikllut’*, warm spots that do not freeze, and *kangiisullerni*, little tributary lakes. There are not many *qecikllut’* and *kangiicullernek* in the drainage.

In earlier days, an abundance of sockeye was observed in mountain canyons. In the past years, these numbers of sockeye have not been observed in these places, and sport fishers are seen either fishing in spawning areas or at the entrances to spawning areas. Henry said,

We who are indigenous to the place show great respect for it, thinking about the fish in it or the bay it flows into. There is no respect shown to it in our days. That’s why the condition exists as it is now with declining numbers of salmon available to fish as well as numbers of spawnout reds. They are getting scarce. Those reds when we catch them, we *ellaamiuciluki*, make them breathe the air of the wild as we dry them. We dry them and we store them away when they are dried.

Goodnews Bay: It was reported that the abundance of sockeye salmon in the river varies from year to year and during the summer. Overall, the abundance may be higher, thought some, but has decreased in areas dammed by beaver.

Sockeye spawning grounds change as the river fills in or new sloughs are created. Elders worried that if the beaver are not dealt with, the spawning grounds will shrink as a result of the dams blocking access to spawning areas. In the early lives of elders, beavers were scarce on the Goodnews River.

There are more sockeye in the main stem of the Goodnews River than the Middle or South Forks, because the main stem has more tributaries flowing from lakes and ponds. But in 2004, beaver dams existed on many of the sloughs, slack water spots, and tributaries. Sockeye are finding new spawning areas. It was not clear if the abundance of sockeye on the Goodnews River has been affected yet by the damming.

Sockeye Salmon Ecology

Several ecological factors were reported by elders concerning sockeye salmon. One is the presence of beaver on rivers and streams, constructing dams blocking the way to spawning areas. Another is drying and flooding in sloughs, slack water areas, and small creeks and streams. Sockeye “are in abundance when the water is right.” Brown bear eat a lot of sockeye, too.



A common sight during the annual salmon run in the rivers of Southwest Alaska. USFWS photo

Chum Salmon (*Oncorhynchus keta*), *Kangitneq*

Chum salmon are abundant in the Kanektok, Goodnews, and Arolik river drainages. Smaller populations of several thousand fish likely occur in the smaller drainages to Kuskokwim Bay. Chum return to the rivers from June through August and spawn during late July to late August. They primarily spawn in the flowing waters of the main river, side channels, and tributaries where upwelling currents are found. The eggs usually hatch in winter and the young fry emerge in the spring. Most juvenile chum salmon rear in estuary and tidal areas of the lower rivers until fall, when they school up and migrate out to sea. Most spend three winters at sea before they mature and return to freshwater to spawn in their fourth year of life. The average weight of chum salmon in the Kuskokwim area commercial harvest is 6.8 pounds.

Description of Subsistence Patterns and Use Areas

Chum Salmon Use Areas

Goodnews Bay: In 2004, salmon were harvested primarily near the mouth of the Goodnews River. In his early life, Bavilla’s family harvested salmon, mainly sockeye and chum, from the beach near Platinum at *Ukvoigar* Creek. During his middle life stage, Bavilla harvested salmon at his summer camp on the Goodnews River, where he stayed all summer harvesting Chinook, chum, and sockeye salmon before returning to Goodnews Bay village before freeze-up.



Chum salmon, kangitneq. USFWS photo

Species Descriptions

Chums and Chinook were harvested at the same fishing spots near the mouth of the Goodnews River. Nets were also set in the river; in front of the mouth was a favored spot.

Osviak: From his early life at Osviak, Charlie remembered that salmon, primarily chums, were harvested at summer camp near Osviak village at the mouth of the river before his family moved up the Osviak River to fall gathering sites. One year during Charlie's early years, his family's summer camp was at *Arliak Quigat* (Kittiwake Creek) in Security Cove, harvesting primarily chum salmon and seal. His family of birth also camped at the mouth of Kinognak Creek in Chagvan Bay during the summer of 1947 and harvested pink and chum salmon.

Chum Salmon Gear Type

Chum salmon are caught in setnets.

Chum Salmon Season of Harvest

Goodnews Bay: Chum and sockeye salmon were the primary species harvested and preserved in the summer. During the summer, chum were also harvested at Security Cove and Chagvan Bay. No fall chum-harvesting activities, for spawned-out chum, were mentioned by elders in either community.

Quinhagak: Chum were caught primarily in June in the Kanektok River.

Chum Salmon Preservation and Processing

It was mentioned that at Osviak, during Charlie's early life, chums were harvested and preserved by drying.



*Salmon being filleted (split) and readied for the drying rack.
USFWS photo*

Chum Salmon Life History

Quinhagak: Chum and sockeye arrived almost simultaneously, after Chinook salmon.

Goodnews Bay: Chum arrived in the Goodnews River after Chinook and sockeye salmon. Some years chum arrive earlier than others. Chum and coho salmon were more common than sockeye salmon in the Middle Fork Goodnews River. Chum prefer the shallow water. Chum, sockeye, and coho salmon migrate up Barnum Creek.

Security Cove: Charlie remembered that when staying at the mouth of



Chum salmon, kangitneq, make their way up the Slug River, which drains into Nanvak Bay south of Cape Newenham. USFWS photo

Arliak Quigat (Kittiwake Creek) in a sod house at Security Cove in his early life, they harvested mainly chum salmon and seals.

Chum Salmon Abundance

Quinhagak: In the past, more chum than sockeye salmon entered the river. In 2004, there was more sockeye.

Goodnews Bay: Chum abundance is steady; however, some years they are more plentiful than others. The chum return to the Goodnews River is generally smaller than the sockeye return. During recent years the abundance of chum returning to the bay has varied little.

Chum Salmon Distribution

Chum salmon are found in the Goodnews, Kanektok, and Osviak rivers, in Chagvan Bay, in and Security Cove.

Coho Salmon* (*Oncorhynchus kisutch*), *Qakiiyaq

Coho salmon are abundant in the Kanektok, Goodnews and Arolik river drainages. Other populations likely occur in the smaller drainages of Kuskokwim Bay. Coho return to the rivers from late July through September and possibly as late as November. Their return to the freshwater seems to be dependent on water levels and temperature. Spawning usually begins in late August, but how late spawning occurs is not known. Coho salmon primarily spawn in the far reaches of the drainage, in tributaries and small channels. The eggs usually hatch in winter but don't emerge until May or June. Most juvenile coho salmon rear in pools, ponds, lakes, and slow-current channels for two winters before migrating to sea in the spring and summer. Coho salmon juveniles migrate extensively throughout drainages and are even known to migrate into other drainages before smolting occurs. They predominantly spend one year at sea before they mature and return to freshwater to spawn in their fourth year of life. The average weight

Species Descriptions

of coho salmon in the Kuskokwim area commercial harvest is 7.2 pounds. Most spend two years in freshwater and one year at sea, returning during their fourth year.

Description of Subsistence Patterns and Use Areas

Coho Salmon Use Areas

Quinhagak: During Henry's middle life stage, coho salmon were harvested primarily from the Kanektok River in early fall after turning red. His fish camp was located at *Pamaatairun*, and coho were harvested from nearby spawning grounds. Late-season coho were also harvested from the Arolik River at Bessie Creek.

Goodnews Bay: When he was a child, Bavilla's family harvested coho salmon from the mouth of *Uqvigar* Creek.

Security Cove and Osviak: When Charlie was a child, his family spent a summer at Security Cove. Coho were harvested after chum salmon at *Arliak Quigat* (Kittiwake Creek).

Coho Salmon Gear Type

Quinhagak: During Paul's early life, his family traveled up the Kanektok River harvesting chum and other salmon with nets. They had little other equipment.

Goodnews Bay: Coho were harvested from the Goodnews drainage with drift and setnets.

Coho Salmon Season of Harvest

Quinhagak: When Elsie was a child, her family harvested coho salmon at first frost. Later in her life, after commercial fishing in late July, her husband set a net and harvested salmon for his family.

Many elders explained that when they were children as well as during their adulthood, coho were harvested in fall time and stored in pits to later be fed to dogs.



Coho salmon, qakiiyaq. USFWS photo

Goodnews Bay: Bavilla said that during his middle life stage coho salmon were harvested from the time they arrived in August late into the fall, until enough were harvested.

Osviak: During Charlie's childhood, his family harvested coho and Dolly Varden from fall camp on the Osviak River.

Coho Salmon Preservation and Processing

Quinhagak: During Elsie's early life at fall camp with her family, at the first frost, when the flies were gone, coho were harvested, gutted, and hung in the bushes, making sure wild animals could not get them. Sometime later, the fish were brought home, a few at a time, and eaten. This salmon was called *qan'ruuaktaq*, fish that was dried upside down hanging by tails. The head cartilage was greatly enjoyed by some.

During the early lives of elders, spawned-out coho meant to feed dogs were stored in earthen pits. Sometimes these fish were also cooked for meals.

Osviak: At fall camp on the Osviak River, when Charlie was young, coho and Dolly Varden were dried.

Coho Salmon Life History

Quinhagak: Coho enter the Kanektok River after sockeye and chum start arriving and Chinook have dwindled to almost nothing. In fall, coho skin turns red, the meat white.

From their summer fish camp on the Kanektok River at *Pamaatairun*, during Henry's middle life stage, he and his wife harvested coho as they staged on the spawning grounds. They harvested coho from a northern tributary, which has since dried up and is no longer a stream. Bavilla Merrit confirmed that when last he went there, the stream they called *Pugyuilnguar* had a gravel bar across it, and spawning could not occur there.

As an adult Paul remembers seeing coho spawning in such numbers that nothing else could be seen through the muddy water. This was a one-time observation, though. Paul recalled that coho and Dolly Varden spawned in a long area of Oyak Creek. Beaver dams have since blocked the creek. These dams are solid because they are built on mud, which is of no use to spawners. Also, *Kinraq* and Takshilik creeks are dammed.

Goodnews Bay: Coho enter Goodnews Bay in late July. They spawn in all three forks and even some of the canyon creeks. Bavilla explained, "Coho go anywhere, just about. Coho go into any river," and "Even if there's a dam, they jump over it." Coho spawn in slack water and behind sandbars. Coho behave differently from other salmon, seemingly able to pass right through beaver dams. Most salmon die by September but some coho stay alive until December.

Coho spawn in *Neqaicugnaq*. Just above *Neqaicugnaq* is Clay Creek, along which is a pond. Brown bears stay at this pond in the summer because it is often full of sockeye and coho salmon. On the South Fork, coho migrate to the slough.

Coho, along with sockeye and chum salmon, migrate to Barnum Creek on the Goodnews River. Charlie explained that most of the creeks off the main river are cold, and most of the small creeks that are cold have fish in them.

Coho Salmon Abundance

Quinhagak: The abundance of coho has changed in localized areas, such as in the creek near Henry's summer fish camp on the Kanektok River. The mouth is now blocked by a gravel bar and coho no longer spawn there.

Earlier in Paul's life, coho were more abundant than now. The spawning grounds were full of fish in those years.

Goodnews Bay: The abundance of coho in the Goodnews drainage varies from year to year. There is an abundance of coho salmon in Middle Fork tributaries, in channels that beavers have not dammed and have not dried up or flooded.

New spawning areas exist in deep back sloughs behind sandbars that were once part of the main channel. The abundance of coho has increased in these areas. New spawning areas are not permanent and change from year to year. Salmon are abundant when "the water is right." In Bavilla's estimation, protecting beaver had the ultimate effect of destroying more and more spawning areas "ruining the river." When Bavilla was a child there were virtually no beaver in the drainage. They were successfully trapped only in faraway places. He first became aware of beaver in the Togiak area and they were "protected" (probably referring here to a bag limit by regulation, not being able to shoot beavers as nuisances, or not being able to destroy beaver dams) or they would not have moved to the Goodnews River, cutting the trees down upriver and ruining spawning grounds. Now they are not protected, but the fur value is so low that they are not hunted, either, explained Bavilla.

Osviak: In the Osviak drainage, from Charlie's observations, coho salmon have been plentiful all the time from the days of his childhood to now.

Coho Salmon Distribution

Coho exist in the Kanektok, Goodnews, and Osviak drainages.

Coho Salmon Ecology

Goodnews Bay: Brown bear stay at some ponds on the tributaries of the Goodnews River during the summer eating spawning salmon. Coho are a hardy species of salmon, able to spawn in a variety of areas. Coho are the only species that appear behind the beaver dams regularly, somehow finding an entrance. See the Coho Salmon Population Trend section, above, for a discussion of the impact of beaver on coho spawning areas.

Pink Salmon (*Oncorhynchus gorbuscha*), Amaqaayak

Pink salmon are abundant on the even-numbered years. They occur throughout the entire study area. Although their abundance is likely greatest in the Kanektok, Goodnews, and Arolik river drainages, other small drainages in the region have substantial numbers of pink salmon. One notable example is the Kinognak River, which feeds Chagvan Bay of the lower Kuskokwim Bay. Tens of thousands of pink salmon have been counted in this small drainage on several occasions (Togiak National Wildlife Refuge files). Smaller populations of several thousand fish likely occur in the smaller drainages to Kuskokwim Bay. Pink salmon return to the rivers from July through September and spawn beginning in August. They primarily spawn in the flowing



Pink salmon, amaqaayak. USFWS photo

waters of the main river, side channels, and tributaries where upwelling currents are found—similar to chum salmon. The eggs usually hatch in midwinter and the young fry emerge in late winter or early spring. Most juvenile pink salmon migrate downstream and rear in estuary or salt water. They will spend one winter at sea before they mature and return to freshwater to spawn in their second year of life. The average weight of pink salmon in the Kuskokwim area commercial harvest is 3.5 pounds.

Description of Subsistence Patterns and Use Areas

Pink Salmon Use Areas

Quinhagak: In his middle life stage, Henry harvested pink salmon from the Arolik River, where there was an abundance.

Goodnews Bay: Pink salmon were harvested at a site near Platinum during Bavilla's early life.

Osviak: Mainly chum, pinks, and a few Chinook salmon were harvested at the mouth of the Osviak River during Charlie's early life. Pink and chum salmon were harvested in Chagvan Bay at Kinegnak Creek, also.

Pink Salmon Gear Type

Quinhagak: Pink and chum salmon were caught in the same-size mesh-nets.

Pink Salmon Harvest Levels

Quinhagak: In 2004, very few pinks were harvested near Quinhagak. However, during Henry's middle life stage, many more could be harvested from the Arolik River, where returning pinks

were abundant. Probably more pinks were harvested in the past because fish were never thrown away. Everything caught was processed and preserved, or eaten fresh. As in Bristol Bay, pinks return in greater numbers during even-numbered years. On the off year, a few pinks might be caught. As many salmon as possible, including pinks, were harvested to feed sled dogs.

Pink Salmon Season of Harvest

Pink salmon are harvested in summer, and there was no indication by elders in either community that spawned out pink were ever targeted for harvest.

Pink Salmon Preservation and Processing

Quinhagak: Pink and chum salmon were preserved using the same methods and typically hung to dry on fish racks.

Pink Salmon Life History

Quinhagak: Pinks arrived in the river in late summer, after Chinook, chum, and sockeye salmon. Some elders, during early and middle life stages, observed large returns of pinks spawning in slack water and eddies in the Kanektok River and they “looked like lots of rocks on the gravel bars. There were so many humpies spawning the water was muddy all the time.” In 2004 the pink return seemed much smaller than during these times.

Pink Salmon Population Trend

Quinhagak: In 2004, the pink return had dwindled to a fraction of what it had been during the early lives of elders. This was noticed especially in the Arolik River. “When they hit that river at night we were awoken by the sounds of their splashing hitting the riverbank . . . their wakes crashed into the riverbank loudly because of the sheer abundance of them.” Large numbers of pinks also returned to the Goodnews River in the past. Paul said, “There were so many they could not become more abundant.” Paul said the more recent population trend is stable or on the rise.

Goodnews River: During Charlie’s middle life stage, pinks were more abundant in the Middle Fork of the Goodnews River than in 2004.

Pink Salmon Distribution

During the lives of elders, pinks were found in the Arolik River and Kinegnak Creek in Chagvan Bay. They were also found in the Kanektok and Goodnews rivers.

Pink Salmon Ecology

Quinhagak: In 2004, fewer pink salmon were observed than during the early and middle lives of elders. Henry said, “Those first people a long time ago, whatever fish they harvested was prepared for consumption. Those first people never threw back fish. Maybe today’s fishermen throw them back. I don’t know why there aren’t as many as years before but among the fish species their numbers have declined.”

CHANGES IN PHYSICAL ENVIRONMENT AND CLIMATE

Lakes, Ponds, Streams, and Sloughs

Certain bodies of water that elders once knew have dried up, and this concerns them because spawning areas and fish habitat are destroyed. The community of Apokak was abandoned in the 1930s due in part to the drying up of the local ponds. Quinhagak once had a large pond just beside it, big enough for float planes to land on, and this too has gone.

Spawning Areas

A well-known coho salmon-spawning area was located upriver from Bavilla's summer fish camp on the Kanektok River at *Pamaatairun*. The stream was named *Pugyuilnguar*. Bavilla had not been there in years, but the last time he saw the stream, a gravel bar covered the mouth, preventing coho from entering the stream. Elders in the study discussed numerous other instances where spawning habitats had been disrupted in this manner, but did not specify exact locations.

Blackfish Habitat

Paul moved his blackfish trap to Eek because the local blackfish were small and getting scarce. This may be because the two local lakes, *Ithagsutlek* and *Tsingigkalik*, where blackfish are harvested, are drying up. Paul thought the lakes were drying because the creeks running to them were filling in.

The Abandonment of Apokak

Kenneth related the story of why his family moved to Eek from Apokak. In late November, a large area south of Apokak flooded and then froze. During a thaw, maybe in spring, the floodwaters retreated very swiftly, breaking through the edges of lakes and permanently draining the lakes and creeks in an area used by people to harvest blackfish and other resources. With fewer creeks draining into Apokak Slough, it became shallow, and families found it necessary to move to another village, most going to Eek.

Today Apokak Slough is "getting ahold of" Warehouse Creek, making parts of it shallow and difficult to boat up in late summer to harvest berries. The creek is navigable only at high tide and deep mud makes it hard to get up on the bank from the boat.

Kuskokwak Creek is also dry.

During years when there is a high level of flooding in the Kanektok drainage, the river channels often change because of the fast-flowing water. Channels that were deep become dry. For example, below the Quinhagak airport was once a small creek that is now part of the main river, and where the main river was is now dry. When Elsie was a child, a lake adjacent to the village broke its banks and drained past the church in Quinhagak.

In the Goodnews River the channels constantly change as floodwaters break through the bank, creating new channels. In the past, the Goodnews River ran swiftly past the narrows before Goodnews Lake. Over the years the river has slowed here, allowing some species such as Dolly Varden to migrate all the way to the mouth of the lake.

Beaver Dams

Beaver dams are blocking access to many spawning grounds that elders remember. Paul remembered that when he was younger, there was only one beaver dam, at the mouth of Taqliqaq Creek, by Pumatai'rutmiut. The old creek bed is now dry and the river channel rerouted to the other side of the river.

Coho and Dolly Varden once spawned in a large stretch of Oyak Creek, a tributary of the Kanektok River. Beavers have put several dams across the creek and, reportedly, fish can no longer travel up the creek. Other dammed spawning areas include *Cayalituli*, close to *Pumatairun*, where sockeye spawned, and *Kinraq*, as well as other streams in the area.

Beaver dams now block many of the spawning areas that Paul remembered on the Arolik River, and some have dried up.

On the Middle Fork Goodnews River, beaver have dammed many creeks and streams. Many of the slack water areas and sloughs that elders remember as salmon-spawning sites are also dammed. Some spawning grounds have become part of the river and others have dried up. Little Raven's Bluff (*Tulukaruiagat*) is blocked by a beaver dam.

Volcanic Eruption

Paul said that ptarmigan were abundant when he was a young boy. He remembers a volcanic eruption and locally there was a ptarmigan die-off. He observed volcanic ash on the Kanektok River at the same time.



Elders have attributed the blocking of traditional salmon spawning areas to an increase in beavers and beaver dams. USFWS photo

Weather Pattern Changes

Kenneth said that when he was a child the area had greater snowfall. Salmonberries do not thrive during certain years, probably because there is not enough snowfall.

DISCUSSION

This project met the overall goal of preserving traditional ecological knowledge of fish and environmental changes observed by six long-term residents of the lower Kuskokwim Bay region. It is difficult, if not impossible, to preserve the great extent of local knowledge that is available. The results of this project form a foundation for future traditional knowledge collection, for distribution of the information to the public, and for future research in searchable databases and full text translations. The following is a discussion of the project methodology and results by project objective.

Review of Methods

A variety of media was employed to record information gathered in all interviews. All interviews were recorded on both videotape and digital sound-recording devices, and notes were taken by hand. Having two options for capturing the data proved most helpful throughout the course of this project, and facilitated considerably the process of interview transcription. In some instances, one recording device used at the interview failed to perform, which was discovered only on return from the field. In other cases, one recording device was turned off for a break while another was left running. Some of these informal sessions led into subject discussion before the interviewers remembered to turn recording devices back on.

The most time-consuming and costly portion of this project was the translation and transcription of the Yup'ik interviews into English. One hour of interview time generated approximately 100 hours of full-time transcription, verification, and final edit. Still, the advantages of conducting the interviews in Yup'ik far outweighed the disadvantages. First and foremost, all our informants were Yup'ik first speakers, and many of them could understand only a minimal amount of English. Conducting the interviews with Yup'ik first speakers facilitated a much better exchange and accuracy of information. Project informants could provide all the taxonomy and place names used throughout this report in context. The ease and comfort provided by speaking in their own language most likely also allowed the respondent to be more open with his or her information and life history.

The translation process also provided fertile ground for learning about the current status of the Yup'ik language. One interesting element that emerged was a discussion of the different dialects of Yup'ik spoken by the elders in this project. Most of the RIT participants were younger than those who were interviewed. Although they understood the Yup'ik spoken by the elders, there was occasional disagreement on the precise meaning of certain words and how they might translate into English. Part of this was because elders and RITs (along with a temporary transcriber), differed in age and location of birth. This influenced the dialect of Yup'ik they spoke and the type of orthography they used. During the course of this project there were many discussions of the fact that dialects within the Yup'ik language were disappearing with the elders, only to be replaced by a standardized, more generic form of Yup'ik that emulated most closely the Yup'ik spoken on the Yukon-Kuskokwim Delta, especially the Yup'ik spoken in Bethel. This was the Yup'ik taught at state universities and bilingual language programs, and the Yup'ik spoken by the next generation. Along with dialectical differences, there was a question of spelling Yup'ik words in English. Some of the RITs were familiar with an earlier Yup'ik-English dictionary first put forth by the Moravian missionary Reverend John Hinz (1944). This is the Yup'ik still found in the Moravian Hymnal and New Testament. Some of the

RITs discussed using the Yup'ik orthography outlined in this tome, claiming that this would be the type of translation the elders would be most familiar with, were they able to read. The final spelling of nearly all Yup'ik words left in the English version transcripts were based on the *Yup'ik Eskimo Dictionary* by Steven A. Jacobson (1984).

Finally, written Yup'ik fluency is achieved by very few people. Although there are standard Yup'ik spellings for the names of all the fish found in this report, often the informant used the plural or added adjectives such as little (“the little trout”) which translate into changed or additional endings. Two considerations are at play here. One, the local transcribers may have used a form of the written language that spells words a little differently than would a linguist. Two, because the translators were not wholly literate in written Yup'ik, the spellings could change or represent different pronunciations, especially in villages like Goodnews Bay or Quinhagak, where many community members have immigrated from other locations in the region.

Review of Results by Objective

1. Inventory and evaluate existing information on subsistence fisheries.

Of the previous work done in the region, we could find very little that was current with regards to subsistence fisheries (see Wolfe et al. 1984; Scott et al. 2001), and even then, there was no coverage of Goodnews Bay in the Community Profile Database. We are aware of no other TEK projects conducted in the region relating to subsistence fisheries.

Extensive interviews in both Yup'ik and English were conducted throughout the state from the 1970s through the 1980s by the BIA ANCSA 14(h)(1) program to document Native historic places and cemetery sites (US-BIA 2003). Many of the interviews for the lower Kuskokwim Bay region had been translated and transcribed, and some were indexed. After reading through the index and determining which interviews had digital transcripts, we found that of the ones accessible only five seemed promising for information on subsistence fisheries. This was by no means an exhaustive effort to read through all transcripts that could hold information relative to this project. The ANCSA collection holds hundreds of interviews from across the state, represented by close to 2,000 taped recordings. The project targeted interviews conducted in the study area, and we did not seek out past residents of the region who had relocated elsewhere within the state. Although there was plenty of interesting regional history on family movement and local villages, the five interviews were most useful in providing data for confirming place names and use locations mentioned during project interviews, and did not have content that could significantly contribute to developing a body of knowledge on local fish species or current and historic subsistence-use practices. Key to the discussion here is the overwhelming number of data within the ANCSA holdings, in various stages of accessibility. Maps from this and other collections were used in the mapping portion of this project.

2. Evaluate 2002 and 2003 interview data to determine relevancy of information.

There was a great difference in the type and extent of information covered between the 2002–2003 interviews of Kenneth Cleveland and Elsie Small, and the interviews conducted with elders in 2004. The species checklist and questionnaires used for the 2004 study kept the later interviews largely focused on covering subsistence-harvest fish species and local knowledge of their particular life cycles and abundance. What was missing was the rich depth of personal life history, detailed stories, and revelations of the Yup'ik world view that emerged from the

2002–2003 approach to data collection. Kenneth Cleveland's interviews revealed a rich source of information on marine and land mammal subsistence practices, whereas Elsie Small spoke more about fish, plants, and berry picking. Not surprisingly, without the strong direction of the species-specific questions, the subject matter that emerged from discussion centered on those resources the individual was most familiar with.

Returning to Elsie and Kenneth to conduct species-specific interviews would no doubt have revealed more detailed knowledge about local fish and the environment that had been untapped. We could not invest the time and resources into adding more data into this project, and the decision was made to go with the information we already had.

3. Identify village Elders to participate in the study.

The project required individuals who had extensive subsistence-harvest experience and lifelong residency in the region. Allowing the RITs and village councils to identify project informants was an effective method for determining those individuals who were community-recognized bearers of traditional knowledge, and who would be most motivated to participate. This method also had the added benefit of providing a venue for community participation in the project.

4. Conduct interviews of four to six Elders to:

- a. Document local knowledge of the life history, distribution, abundance, and ecological relationships of the anadromous and resident subsistence-fisheries resources, and how that may have changed over time.
- b. Document historic subsistence-fishery harvest patterns and traditional fishing areas, and how they may have changed over time.
- c. Document local elders' observations concerning changes in the climatic and physical environments.

The raw data of translated Yup'ik interviews provided an extensive body of information, over and above the focus of this project. Although the target of the interviews was to stimulate recollection of subsistence-harvest and TEK on local fish species and change over time, within each session there is a wealth of information outside the project focus that should still be of great interest to biologists, historians, land and resource managers, social scientists, and local communities. Thus, the value of recording an interview over note taking needs to be emphasized. Although it was a long and costly process, people can access the data firsthand without having to rely solely on someone else's synthesized account. We incorporated from the interviews into this report only those data that bore relevance to the original intent of this project's objectives. Having a full transcript of the interview leaves a rich treasure trove of information that may still be of use to other projects and research efforts.

This project methodology did not intensively concentrate interview efforts on gathering the TEK of one species as has been done in other studies (e.g., Georgette and Shiedt 2005). Instead, this project identified species of subsistence importance that warrant more directed research. During the interview process, some elders did not provide information on certain species. These elders either did not want to share that information or did not have particular knowledge (life history, distribution, spawning, run timing, etc.) of the species in question.

Based on the length and number of comments, it is evident that salmon (Chinook, chum, sockeye, and coho), Dolly Varden, and rainbow smelt are the most important fish species harvested for subsistence. Other species utilized intermittently or for special purposes included spawned-out sockeye salmon, Arctic grayling, round whitefish, rainbow trout, and Bering cisco. One of the factors that emerged during the interviews in determining the importance of nonsalmon species to the subsistence harvest was accessibility and availability of species during the winter. It is obvious that salmon, both for quantity and abundance, are the primary target for an annual subsistence harvest, but these fish are available only during one concentrated period over the course of the year. Species availability in the winter is crucial for supplementing the diet with fresh meat and variety.

Species that once featured prominently in the regional diet but have seen a decline in harvest include blackfish. Elders attributed the decline in population abundance and fish size to the shift in harvest effort to other species, or the relocation of people away from areas of blackfish concentrations, or to habitat changes, rather than to harvest or other predation. Blackfish were once very important to the annual diet of these elders. Although many of the elders in our project still ate them on occasion, set traps for them, or knew of others setting traps, there was general consensus that people do not target for subsistence or eat blackfish now as they did in the past. Blackfish were caught and eaten on hunting expeditions in the winter, providing a fresh food source for both hunters and dog teams. That dog teams are no longer used could be another reason why blackfish are no longer eaten as they once were. Although most elders reported a decline in fish size in the lower Kuskokwim Bay region, many also indicated that the blackfish up in the Kuskokwim River region were still plump and meaty. Finally, in the interviews there was reference to blackfish being used as a reliable source of food in lean times, especially during winter. A decline in blackfish harvest could be an indicator of an adequate annual preferred food supply.

Relatively few new observations were provided pertaining to the fish species distribution throughout the study area that adds to the existing literature on Quinhagak. Most elder observations seem to confirm the last available reports from Wolfe (1984) and the CPDB (Scott et al. 2001). The notable exceptions were the observations and harvest strategies for burbot and pike. The only place in the study area where burbot and pike were mentioned to occur was around Apokak and *Ciniq* (*Siniq*) village sites—Apokak Slough and Warehouse Creek. The respondent from these abandoned village sites talked about the harvest of burbot and pike in this area during spring. These species are not mentioned by the other respondents in any other area. Several elders pointedly said that there were no pike in the area, they “have never seen one,” or that they occur only up near the Kuskokwim and Eek rivers.

Cod or tomcod are referred to, but the species targeted is unclear. Refuge Information Technician Pete Abraham identified them as Pacific cod, whereas Wolfe et al. (1984) referred to saffron cod. Since they were reported to be caught in the winter, the usual spawning season for cod, these could be immature fish that had moved inshore during high tide.

Arctic char and lake trout are recognized as occurring throughout the study area by the elders (“You have to go to the lakes”) and contemporary literature (Mecklenburg et al. 2002; Morrow 1980; Wolfe et al. 1984), but are not considered by project elders as important subsistence resources. When asked, most of the project elders indicated Arctic char and lake trout were incidental catch during pursuit of a more favored species such as Dolly Varden, and one elder stated that no one actively targets them for subsistence purposes. During the lives of the project

elders, their migrations and inhabitations were more focused on coastal areas and resources. Because these species occur in the headwater lakes, a good distance from the coast, these elders probably didn't have the mode of transportation or desire to travel to these areas regularly. They lived where the resources were more concentrated and had little use for the sparse fish resources in the mountains. There is also mention of a pointed harvest of these fish in the wintertime during fishing through the river ice. One of the elders said that people around Bethel target these fish during the winter. Arctic char and lake trout seem to have taken on less significance as time progressed.

Dolly Varden are reported to be widely distributed throughout the major drainages in the lower Kuskokwim Bay area. The local knowledge and description of this species indicates the importance of this fish to the project elders throughout their lifetimes. This species is still important today, although it is likely fewer are harvested now compared to 50 years ago. One elder stated that he has observed a decline in Dolly Varden on the Goodnews River since people started seining. Several elders referred to fewer fish of all species being harvested now compared to when dog teams were being used. A few of the other species, such as Arctic char and rainbow trout, are incidentally harvested while Dolly Varden are being targeted in the winter ice fishery. Much of the harvesting effort occurs in the lower river areas near the villages. Not only is this a practical approach to conserving resources (gas and machines), but the popular areas for ice fishing are also documented areas of Dolly Varden overwintering concentrations (Lisac 2002, 2003, 2006; Lisac and Nelle 2000).

Rainbow trout have been harvested throughout these elders' lives, primarily as incidental catch during the winter ice fishery (see above). This is consistent with use patterns reported by Wolfe et al. (1984) and the previous surveys conducted to document customary and traditional use for this species (Lisac 1992). Rainbow trout were reported to be targeted specifically for special occasions during a survey of 52 residents in Quinhagak. They harvest rainbow trout from the Kanektok and Arolik rivers in the same areas as described by the elders in this current study. During the 1992 survey, the Goodnews Bay Traditional Council thought that a survey of rainbow trout harvest patterns would be a waste of time, since they are harvested only incidentally. However, one elder noted that rainbow trout numbers seem to have declined over the last 50 years and suspects that sport fishermen are responsible for this. He also implied that more would be caught and eaten if their numbers were greater. Some people will not eat rainbow trout because the trout are said to eat voles.

Grayling distribution was said to be increasing in the Kanektok River although some informants didn't think they were abundant in the Goodnews drainages. Project informants indicated that they were also a species targeted for a special harvest when they could be found (usually with round whitefish), and eaten fresh.

Round whitefish are suspected residents of this area solely based on Morrow's 1980 work *Fresh Water Fish of Alaska*. However, this is a generalized statewide accounting of species distribution, and no other documentation exists to confirm this. The elders provided some evidence for this species occurring in the Kanektok, Arolik, and Goodnews rivers and lakes.

Bering cisco had not been previously documented as an important subsistence species (Wolfe et al. 1984). All elders talked about the harvest of this species; they had observed an abundance of Bering cisco on the Kanektok, with their numbers reported to be growing on the Goodnews River. They are still taken in the winter, snagged during ice fishing, when the individual is in

the mood for a fresh meal. They are caught to be eaten immediately and there is no discussion of preservation or processing of these fish. As with other species mentioned above, Bering cisco seem to be most important during times when there is a shortage of the preferred subsistence resources.

Rainbow smelt are widespread throughout the area and an important component of the subsistence harvest. They are not only abundant, but are accessible to the subsistence fishermen from fall to late spring. Wolfe et al. (1984) also reported that smelt were harvested in great quantities.

Capelin are rarely harvested and not reported to occur north of Goodnews Bay by these elders. Wolfe et al. (1984) did not report any harvest of this species for either village.

Pacific herring and herring roe-on-kelp (or eel grass) does not appear to be as important a subsistence food source as in other areas to the south and north (Togiak and Nunivak Island).

The average annual subsistence salmon harvest has declined from 14,000 to 10,000 between the 1989–1993 average and the average of 2000–2004 harvest (Caylor 2006). Project elders identified a few factors that may have contributed to this trend: fewer people actively pursue, prepare or preserve fish for the winter—they have more of a “westernized” diet; also, caribou and moose populations have increased in the area and now make up a greater percentage of the region residents’ subsistence diet, decreasing the actual amount of salmon eaten annually.

Although overall salmon harvest is down, Chinook salmon are harvested in greater quantity now than during the elders’ early lives. Elders attribute this to more efficient technologies. These large salmon were difficult to catch before synthetic gillnets and boats were used.

Sockeye salmon continue to be an important food source. They are primarily the only salmon that is targeted as “spawn outs”.

Project elders appeared to have great familiarity with chum salmon. Chum salmon generally are the most abundant species in the smaller coastal river systems that don’t have headwater lakes, where the elders report having family summer camps.

Coho salmon were probably used more during the time when dog teams were in use some 30 to 50 years ago, since they are the last salmon to return before winter. Today, coho salmon harvests are down, although they still account for more than 30% of the subsistence salmon harvest (Caylor 2006). Late-season coho are valued because in the cool weather there are no flies and mosquitoes and the fish preserve well. The elders recognized that variations in annual abundance are natural, but thought that coho salmon are actually more abundant now than in the past. Historic data of coho salmon escapement is not available to assess this claim.

Pink salmon are not as important now as in the past. This is probably due to the factors discussed above, including the fact that larger harvests are no longer needed to feed dog teams, that increased efficiency in harvest gear has allowed increased harvest of other, larger species such as Chinook, or simply that “abundance has dwindled.” Project elders reported that the abundance of pink salmon is now a fraction of what it once was. There are no historic data to assess this claim, but there is a consensus between elders, sport fishers, and biologists on this observation.

5. Create a relational database of TEK information searchable by type, species, and geographic location.

Creating a relational database of all project interviews was an essential step in the organization of data. There are few known tools that could process information from this number of interview transcripts in such a reasonable amount of time. The AskSam database takes an interview transcript that is thick with disorganized information, and turns it into easily consumable data sets. The AskSam database system provided an excellent framework and tool for project-related and future analysis. Interview segments were broken down into content areas and the individual fields were filled with searchable keywords identified by the researcher. This approach to cataloguing research text is limited only by time, researcher vision, and scope of the raw data themselves. Once the time-intensive field-and-keyword framework is completed, search and analysis are quickly facilitated for any interested researcher of any likely topic under the purview of the project.

In organizing information in the interview, each data set pertains to a particular subject section of the interview in chronological order. This puts the researcher in direct contact with the section of the interview that pertains to the subject of his or her interest *in context*. The researcher is able to tab forward or backward in the interview transcript to view other information identified by the search field. With these features the database allows the researchers to produce an accurate overview of the local knowledge provided by the informants.

There are shortcomings to the field-and-keyword search function of AskSam. The word search was often preferred over the field search for data analysis. This was to check that all the notes on a species were being viewed. With grayling, for instance, there was interesting information that was not getting viewed through directed field and keyword searches. One of the reasons for this was that grayling was often discussed in the context of other species, and more keywords could or should have been added to that text section field format. Finally, neither field nor word searches are any replacement to reading the interviews, from start to finish, for a complete understanding of the flow of knowledge and subject matter covered in the session.

6. Create a spacial database.

The spacial database developed for this project is a stand-alone product that can be accessed using ArcReader (Environmental Systems Research Institute) software. In addition to the maps containing features by elder, species, season, or area, the project also contains hyperlinks to interview text. The hyperlinks between the GIS and the AskSam database serve multiple purposes. The feature adds the actual passage from the interview transcript to the map project, which can be accessed from the map viewer. The user can access a quick summary of the information about a place, an animal, or a subsistence activity that occurred at that location. The hyperlinks also allow the user some perspective of the spatial accuracy of the information. Sometimes information referred to a specific site or place name, or to a general description ("along the river up near the mountains"). Map features reflect these descriptions and the user can access the text to get the full context of the feature. The hyperlinks also bring together information from throughout an individual's interview that pertains to the same site or species.

Some of the concerns about this portion of the project are accessibility of the data to local people and participants of the study. The database will be given to each village council and may be given to the elders of the project, but it is recognized that most lay persons may have difficulty using this type of program. Another interesting topic for discussion is the process of

data collection itself. Some of the elders were specific about locations and places on the maps used during the interview and demonstrated a high level of comfort with utilizing hard-copy maps. Other elders barely looked at the maps but provided detailed descriptions of the land, demonstrating an ability to identify specific features of the local landscape. In these latter cases, the interviewer had to be more general about mapped locations and the results of these sessions were more challenging to enter into the database.

RECOMMENDATIONS

This project provides a compilation of traditional knowledge of the subsistence fisheries resources held by six individuals from two communities in the lower Kuskokwim Bay area. Although the interviews documented the life experiences of the six participants, there are many more individuals in the area who have experiences that would contribute to the database, benefiting federal subsistence management, the local and indeed, statewide communities of Alaska. The lack of quantified nonsalmon subsistence harvest information for Goodnews Bay, Platinum, and Quinhagak needs to be addressed. The CPDB includes some subsistence harvest data for Quinhagak from the year 1984 only, and includes no data for Goodnews Bay. Specific recommendations for subsistence-fisheries managers and researchers to conduct additional work in this area include the following:

- Subsistence harvest surveys and community profiles should be updated for the villages of Quinhagak, Goodnews Bay, and Platinum. Special emphasis should be on the harvest levels of nonsalmon resources and winter subsistence-fisheries activities.
- Today's observations are tomorrow's TEK. Individuals currently in their "middle" life stage, who are active pursuers and providers of subsistence resources, should be enlisted to participate in a continuation of this study. Because methods and modes of travel have changed, this age group of people would provide a good overlap with the elders, whose information is provided in this study, and may fill in the data gaps for the individual species.
- The databases should be shared with others and expanded. Area residents, biologists, and researchers should be provided with the AskSam database and be encouraged to provide current and previously recorded observations for inclusion. Similar to the above recommendation, today's observations will be useful to managers in the future.
- A central repository should be established to promote contributions, and to make frequent updates to these databases. This might best be done on a regional basis before it is attempted on a statewide basis. Combination of these databases with other, similar projects (BBNC Place Names Project and OSM's Neqa to Tepa) is the next rational step in this process.

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APPENDIX

INTERVIEW MANUAL

This manual should be used as instruction for and a reminder of the interview protocol used in the Oral History and TEK Project in Togiak NWR. It is designed to be used as a checklist for each stage of the project. The different steps of the project that the interviewer must be aware of are laid out.

STEPS TO PREPARE FOR AN INTERVIEW

- 1) If this is not the first interview for an individual Elder, be sure to review any past interview sessions and files created with the Elder.
 - Review Context Sheet and Species Questionnaire Checklist for all interviews conducted with the Elder.
 - If necessary, review videos of all interviews conducted with Elder (if for some reason the checklist and Context Sheet cannot be found).
- 2) Before going into the field make sure that you are carrying all necessary paperwork for the project.
 - Release Form. (during the pre-interview)
 - Pre-Interview Elder Background sheet.
 - Interview Context sheet.
 - Species Questionnaire Checklist: Use this during the interview to help guide both yourself and the Elder through the species and topics of relevance to this project.
 - Maps (will probably need at least four sets of area maps)
 - Map legend (key) for each map.
 - Species Identification Keys: These are very important in verifying precisely which species an Elder may be discussing.
 - a. Fish ID Key (including Whitefish Poster).
 - b. Bird book and one-page bird ID.
 - c. Mammal guide (marine and terrestrial).
- 3) Make sure that all necessary equipment is available and operational BEFORE going into the field, and that you know how to operate and assemble each one. Bring back ups if available.
 - Check all cameras, video and still.
 - Check and pack all audio-recording devices.
 - Make sure you have at least one tripod.
 - Make sure all equipment is in order and there are extra batteries, tapes, and memory chips and all appropriate extension cords.

THINGS TO REMEMBER DURING THE INTERVIEWS

When beginning any interview, please keep in mind the following guidelines:

- Make sure that the interview location is comfortable, quiet and secure.
- Make sure that the Elder has some water handy, and if possible a snack.
- Label the videotape and audio-chip before the interview begins with the name of the Elder, the date, and which interview it is.
- When starting an interview, wait for the header to run out on the tape, then begin the session with a spoken context statement stating the date, the interviewer, the person being interviewed, any others who may be present in the room, and the reason why the interview is being conducted.
- Ask only one question at a time
- Give the Elder time to fully respond before asking another.
- If the Elder begins to wander, let them finish a thought, but guide them back on track with questions like “OK, when you were talking about.....” before guiding them back to our area of interest.
- Do not to ask questions that result in a simple “yes” or “no” answer. If a “yes” or “no” answer is given, try asking them to explain more.
- During the interview, use the questionnaire and checklist to help keep track of what is being discussed, and what might benefit from more in-depth discussion.
- When an interview is finished, please state that the session is over and thank the Elder on tape.

Immediately after the interview is finished fill out the Context Sheet before leaving the premises. This will ensure that all the details of the session are still fresh in your mind.

- Write the date and time, the name of the Elder, the interviewer, and any other individuals who may have been present during the course of the session.
- Please note which maps were used.
- State the purpose for the interview.
- Write a brief description of the topics discussed.
- Finally, include any information that may not be immediately evident on the video, or may be important to understand about the session that will not translate on the transcript.

CONTEXT SHEET

Interviewee: _____

Date: _____

Village: _____

Interviewer(s): _____

Interview Location: _____

Interview #: _____

Others Present: _____

Notes: (describe events and circumstances surrounding the interview)

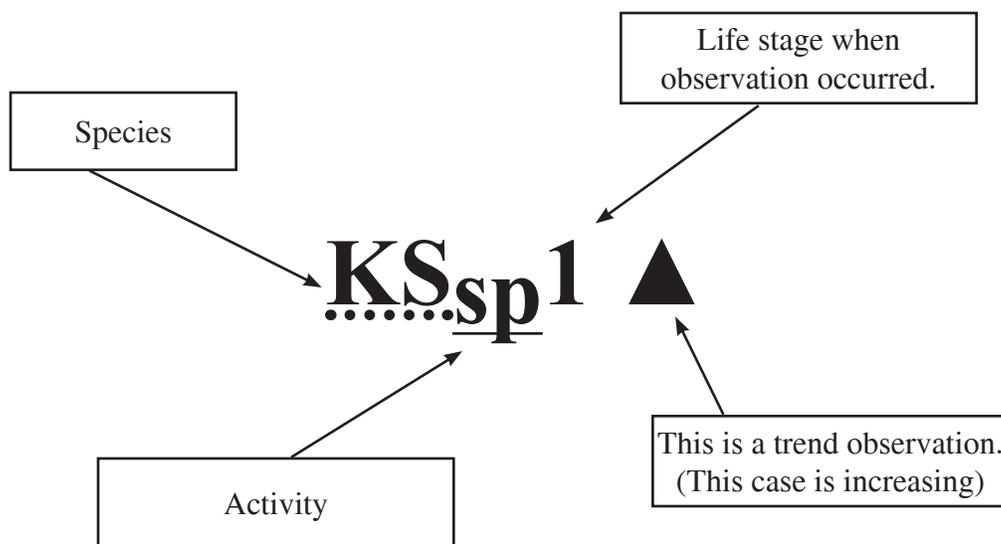
MAPPING

Mapping is very important at every step in the interview process. Be sure to have blank maps available, use the map legend (key), and be consistent. During the course of the interview session:

- Recognize when it is appropriate to begin mapping the information. When the conversation begins to focus on specific species and subsistence use locations, direct the Elders' attention to the map and clarify: what, where, when, and how much/how many.
- Always get the Elder to confirm the information before writing it on the map.
- A new, clean set of maps should be used with each elder. When the maps become too crowded get another set.

How to label map observations:

It is important to be consistent in how you label map observations during the interview process. Color pencils are used for the four seasons. The legend is included here, but a copy of the legend with any notes or code changes should be included with each map completed.



MAP LEGEND

SPECIES ABBREVIATION LIST		ACTIVITY CODES	
ABR	SPECIES	COLOR	SEASON
SAL	All Salmon	YELLOW	Spring
KS	King	GREEN	Summer
RS	Sockeye	RED	Fall
CS	Chum	PURPLE	Winter
SS	Coho		
PS	Pink		
		Code	Life Stage
CH	Char	1	Youth
DV	Dolly Varden	2	Adult
AC	Arctic Char	3	Elder
LT	Lake Trout		
		ABR	ACTIVITY
AG	Grayling	sp	Spawning
RT	Rainbow Trout	r	Rearing (Juvenile)
NP	Northern Pike	ovr	Overwintering
BF	Blackfish	m	Migration
BU	Burbot	h	Harvesting
WF	Whitefish	st	Staging
RW	Round		
BC	Bering Cisco		
LC	Least Cisco	▲	Increasing Since Then
BR	Broad Whitefish	▼	Decreasing Since Then
HW	Humpback Whitefish		
SF	Inconnu (She fish)		
SC	Sculpin		
ST	Stickleback		
HE	Herring		
HA	Halibut		
FL	Flounder / Sole		
CO	Cod		
SM	Smelt		
CA	Capelin		

POST-INTERVIEW — MUST DO'S.

Once an interview is finished, it is very important to process and organize all the documents produced in the field. After all notes and interview media have been completed and properly labeled they should be copied as quickly as possible. The master file should be stored in the Refuge Office. All working copies should be copies of the originals.

Put all interview forms and notes in the Elder's personal folder. Each folder should contain:

- A Release Form
- Pre-Interview Elder Background sheet
- Interview Log Sheet
- File Management To Do List
- Species Specific Checklist
- Interview Context Sheet(s)
- Maps used during interviews
- Map legend for each map
- Additional Notes taken during interviews

- File all paperwork in the Elder's personal folder in the dedicated storage space in the Togiak Refuge Office (Dillingham).
- Make sure that all progress is marked on the Interview Log Sheet, and tasks are then recorded, marked off or added to the File Management To Do List.
- Make three copies of the original tape and audio files, and two copies of the Release Form.
- Once finished making copies, make sure the originals of both items are properly labeled and stored safely in the Refuge Office in Dillingham.
- Send one video copy to the village (with a copy of the Release Form), and keep the other copies to be used as the working copies for the Refuge office and interview translator.

This kind of project requires not only preparation, but flexibility as well. At times it will be necessary to make some quick decisions based on good judgment and experience because of situations not covered in this set of guidelines. Remember the goals of the project. Recommendations and change are also an integral part of any successful research undertaking.

INTERVIEW PROCESS

The interview process contains three steps: (1) pre-interview, (2) life stage subsistence seasonal cycle, (3) species specific questions.

Pre-Interview

The pre-interview is intended to explain the project to the elders, talk about how the information will be recorded and used, gather some basic background information from each Elder, and have them sign the Release Form.

- Follow the pre-interview topics listed below to guide the pre-interview.
- Fill out Pre-interview Elder Background Information sheet.

Pre-Interview Topics

- 1) Discuss project goals and objectives:
 - a. Gather TEK for the fisheries resources of the Lower Kuskokwim Bay area.
 - Document local knowledge of the life history, distribution, abundance, and ecological relationships of the anadromous and resident subsistence-fisheries resources and how that may have changed over time.
 - Document historical subsistence-fishery harvest patterns and traditional fishing areas and how they may have changed over time.
 - Document local Elders' observations concerning environmental change.
 - a. Create a database of TEK information so that relevant information is searchable by type, species and geographic location.
 - b. Create a GIS (map) database containing geographic TEK information.
- 2) Explain how the information will be used.
 - a. By local communities.
 - b. Final products (videos, transcripts, databases) will be made accessible to the local school districts.
 - c. Final products will be made accessible to interested scholars and future generations.
- 3) Explain interview equipment and how it will be used:
 - a. Video and audio tapes.
- 4) Explain the interview process:
 - a. Discuss the questionnaire
 - b. Mapping procedures
- 5) Discuss the Stipend:
 - a. Explain that a one-time stipend shall be paid for their participation in this multi-year project.

- b. Explain that we may need to conduct many interviews to make sure we get all the information correctly.
- 6) Request the Elder's signature for the Release Form.
- 7) Determine a convenient time for the first interview.

PRE-INTERVIEW ELDER BACKGROUND INFORMATION

Elder's Name: _____

Date of Birth/Age: _____

Community: _____

Birth Place: _____

Places Lived Through-Out Life: _____

Subsistence Use Locations: _____

Background Notes on Employment and/or Life History (if relevant):

RELEASE FORM
PHOTO/VIDEO AND DIGITAL VOICE RECORDINGS

INSTRUCTIONS - Use of images and likenesses, digital recordings in U.S. Fish and Wildlife Service products

A signed release is required from non-Service subjects in all photographs, video taken by Federal employee or their contractors. In the case of minors, the parents or guardians must sign the release. In the case minors, the parents or guardian must sign the release. Completed release forms must be maintained on file at the originating office and sent to the Regional External Affairs Office prior to use in any Service products

PHOTO/VIDEO/DIGITAL AUDIO TAKER: _____

OFFICE AND PHONE: _____

I hereby grant or digital audio/video permission to the U.S. Fish and Wildlife Service to use my, photographic, video and digital audio likeness in official Service publications and displays, and on it Worldwide Web sites (WWW) without further consideration, and acknowledge the Service's right to crop or treat the photograph, video and digital recording at its discretion

I also understand that the image can be downloaded by a computer user in or out of the Service. Therefore, I agree to indemnify and hold harmless from any claims the following:

- I. U.S. Fish and Wildlife Service
- II. U.S. Department of Interior
- III. All employees within the Department of the Interior

NAME: _____

DATE: _____

ADDRESS: _____

PHONE: _____

SIGNATURE: _____

LIFE STAGE SEASONAL SUBSISTENCE CYCLE

This interview is structured around the Elders' seasonal round of subsistence activities over the course of three life stages.

You should explain to the Elder that you plan to cover all life stages during the course of one session (1–2 hours).

- Use the questions below to assist in guiding the interview.
- Be mindful of species abundance and decline.
- If a population trend is mentioned, it is very important to determine from what time that trend was noticed, whether it has changed, and when those changes occurred.
- Label information on maps

During this interview focus on:

- Where the Elder lived and worked
- Location of activities
- When activities occurred
- Technology employed
- Species that were emphasized
- Mapping of all pertinent information

Life Stage Seasonal Subsistence Cycle Questions

- 1) Describe your seasonal round of subsistence activity:
 - a. In your youth?
 - b. In your adulthood (the time when you became a provider)?
 - c. As an Elder (this may include your knowledge of community & family member harvest)?
- 2) Have you observed any change in the environment and climate over time?

Species-Specific Interviews

These sessions will strictly focus on fisheries information and rely heavily on good mapping techniques. We hope to cover all necessary information in one to two sessions of 1–2 hours each.

- Use the questions below and the Species Questionnaire Checklist to keep track of what information is left to gather per species.
- Use maps and map key.

SPECIES-SPECIFIC QUESTIONS

The groups of questions below relate to the Species Questionnaire Checklist. Use the checklist to keep track of the questions that have been asked relative to each of the species.

- 1)
 - a. Where does (species name) occur (ask them to show you on a map)?
 - b. Where and when does this species (ask them to show you on a map):
 - Stage?
 - Spawn?
 - Rear (spend its youth)?
 - Migrate?
 - Overwinter?
 - c. Have you observed changes in these activities over time? (Map)
 - d. Have you noticed any special relationships between this species and other species, or this species and the environment?
- 2)
 - a. Where and when does harvest occur (ask them to show you on a map)?
 - b. Has this changed over time?
- 3)
 - a. What methods were used for harvesting and processing this species?
 - b. Has this changed over time?
- 4)
 - a. Have you noticed any change in this species population over time? (Map)
 - b. (If yes) What do you believe this change is caused by?

SPECIES QUESTIONNAIRE CHECKLIST

PAGES _____ OF _____

Respondent: _____

Species	Yupik Name	1				2		3		4	
		a	b	c	d	a	b	a	b	a	b
All Salmon											
King salmon											
Sockeye salmon											
Chum salmon											
Coho salmon											
Pink salmon											
Char (general)											
Dolly Varden											
Arctic Char											
Lake Trout											
Grayling											
Rainbow trout											
Northern pike											
Blackfish											
Burbot											
Whitefish (general)											
Round whitefish											
Bering cisco											
Least cisco											
Broad whitefish											
Humpback whitefish											
Inconnu (She-fish)											
Sculpin											
Stickleback											
Herring											
Halibut											
Flounder											
Sole											
Cod											
Smelt											
Capelin											